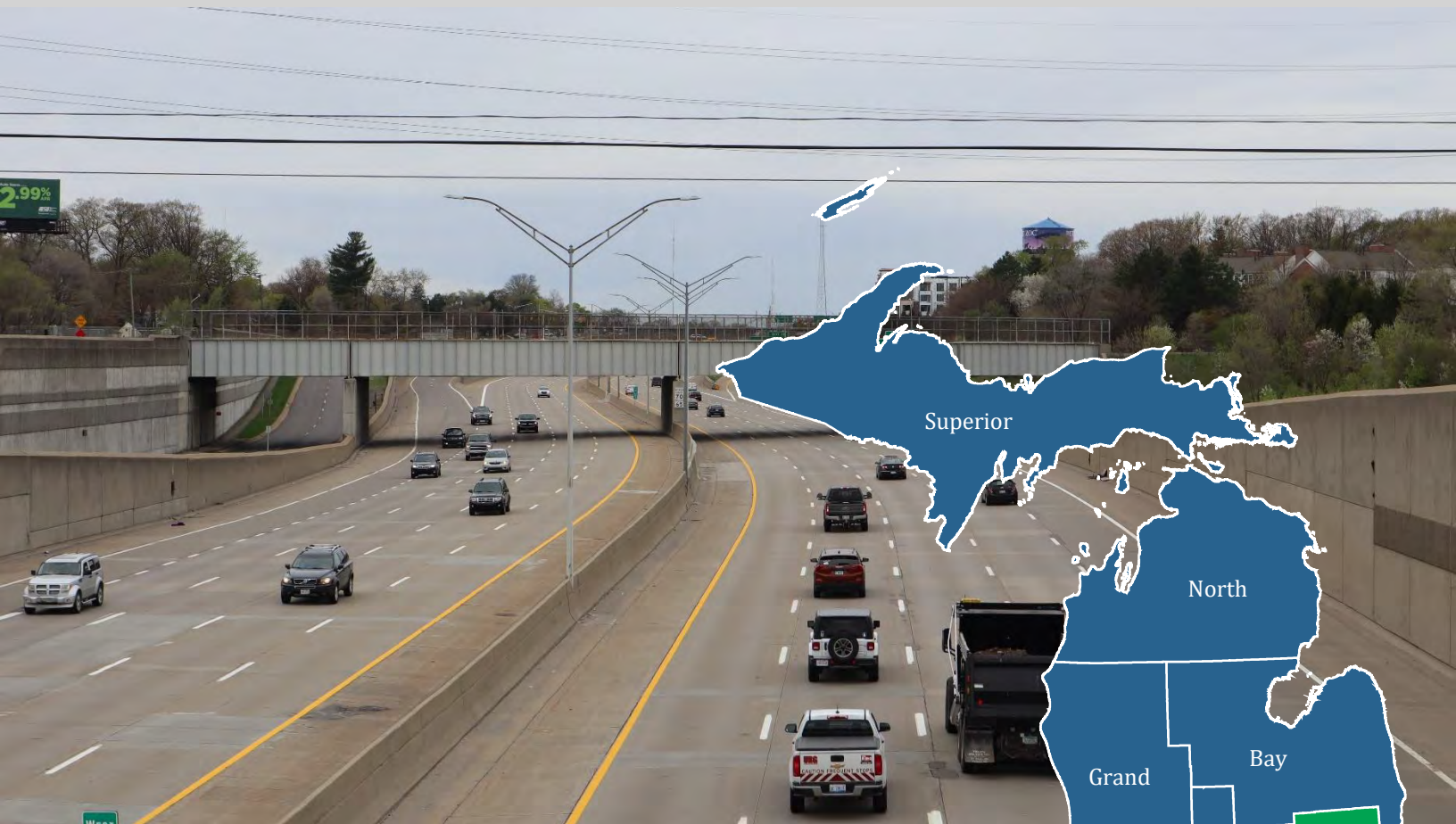


# 2019 Freeway Congestion & Reliability Report



## Chapter 4 **METRO REGION SUMMARY**



## PROLOGUE

Since 2014, the Michigan Department of Transportation (MDOT) has used probe vehicle data to create an annual Freeway Congestion and Reliability Report. The probe vehicle data is collected anonymously from GPS enabled devices and in-vehicle telematics to provide real time speeds on roadways nationwide. Probe vehicles provide an enormous amount of data which can be difficult to manage, maintain, and analyze. The University of Maryland Center for Advanced Transportation Technology (CATT) Lab developed a visual analytics platform called the Regional Integrated Transportation Information System, or RITIS. This tool allows MDOT to monitor speeds, incidents, weather, special events, and many other data sources. Using the RITIS platform, data was downloaded, processed, and compiled into a report summarizing all freeway routes in Michigan.

This report is composed of eight chapters. The first chapter summarizes performance measures and statewide metrics. The remaining seven chapters use those performance metrics to characterize congestion in each of MDOT's seven regions. This document is for internal use to help MDOT regions, Transportation Service Centers (TSC), and planners understand how Michigan freeways are operating over time, as well as where potential improvement projects may be necessary. This report is typically used as a starting point for more detailed analysis incorporating additional probe data, as well as other MDOT resources. If your area has plans to share this information externally, please contact the Congestion and Reliability Unit to ensure the correct measures are being used.

The report was prepared by the Wayne State University Transportation Research Group under the guidance of the Congestion and Reliability Unit at MDOT. Please contact the Congestion and Reliability Unit if you have any questions/comments or would like to have the actual data for further analysis.

## ACKNOWLEDGEMENTS



Jason Firman – Congestion and Reliability Manager

Lee Nederveld – Operations Engineer

John Engle – Operations Engineer

Peggy Johnson – Departmental Analyst



**WAYNE STATE UNIVERSITY**

Jenna Kirsch – Graduate Research Assistant

Steve Remias – Assistant Professor





## TABLE OF CONTENTS

<b>INTRODUCTION</b>	Page 4
<b>PERFORMANCE MEASURES DEFINITIONS</b>	Page 5
<b>PERFORMANCE MEASURES VISUALIZATIONS</b>	Page 8
<b>BAY REGION: OVERVIEW</b>	Page 16
<b>BAY REGION: CORRIDOR GLOSSARY</b>	Page 24
<i>I-75: Taylor TSC, Detroit TSC (55 MPH), Detroit TSC, and Oakland</i>	Page 25
<i>I-94: Taylor TSC, Detroit TSC (55 MPH), and Macomb</i>	Page 39
<i>I-96 and I-96 LOCAL (55 MPH): Oakland, Taylor TSC, and Detroit TSC</i>	Page 51
<i>I-275: Taylor TSC</i>	Page 68
<i>I-696: Oakland and Macomb</i>	Page 75
<i>M-10: Detroit TSC (55 MPH) and Oakland</i>	Page 85
<i>M-14: Taylor TSC</i>	Page 94
<i>M-39: Detroit TSC and Oakland (55 MPH)</i>	Page 99
<i>M-53: Macomb</i>	Page 107
<i>M-59: Oakland and Macomb</i>	Page 114
<b>CONCLUSION</b>	Page 121
<b>CONTACT INFORMATION</b>	Page 121





## INTRODUCTION

The purpose of this document is to provide a performance overview of Michigan freeways. Using probe vehicle data and systematic performance measures, a series of visualizations were created for each region in the state. Chapter 4 of this report provides an overview of the Metro Region. Metro Region is made up of 3 counties and contains the cities of Detroit and Pontiac. Ten freeways are analyzed in the section below.

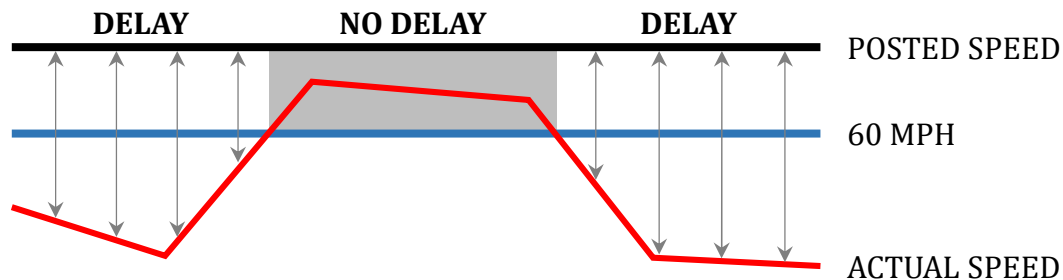




## PERFORMANCE MEASURES DEFINITIONS

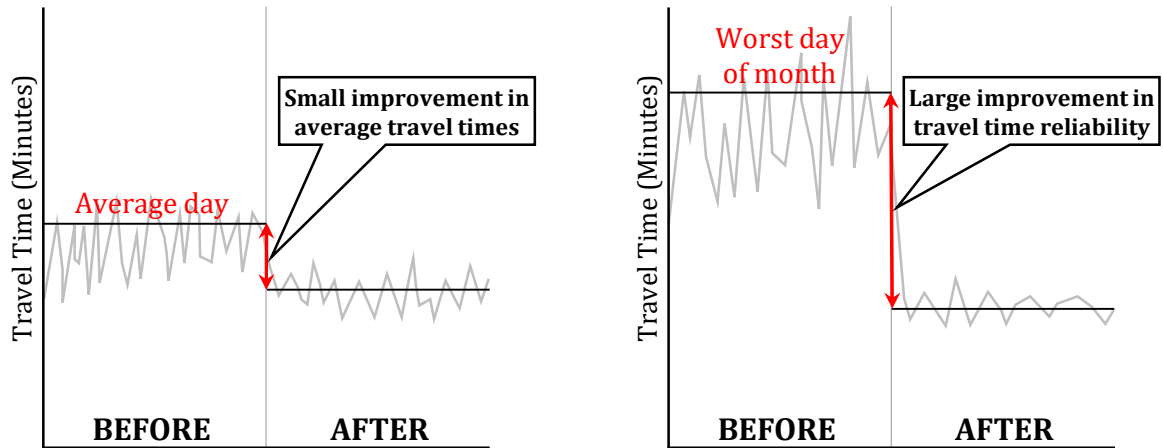
The probe data alone provides representative speeds on predefined segments of roadway every minute. Although this data is rich, it provides limited use to engineers and practitioners without well-defined aggregation techniques. Performance measures are growing in the transportation arena to better monitor traffic conditions, improve traveler information, and identify congested areas with the aim of improving operations on roadways. A summary of the performance measures used in this report can be seen in Table 1.

The goal of these performance measures is to quantify the congestion, delay, and reliability of the freeway network in Michigan. Numerous metrics were used in this report to quantify the performance of the road network, including a new delay index. Delay is quantified when the speed drops below 60 MPH, which is at least 10 MPH lower than the posted speed limit for the freeways (Figure 1). On segments with a speed limit of 55 MPH, delay is calculated when speed falls below that threshold. The delay index presented in this report represents the total delay on each segment if one vehicle were to drive that segment every ten minutes. The lower the value, the better the freeway segment is operating. The other element of interest is reliability. Reliability is a measure of the consistency of a travel time on a roadway. A roadway that has the same travel time every day is said to be reliable, whereas a roadway that has varying travel times is said to be unreliable. MDOT's goal is to provide reliable travel times with minimal delay. This is done through roadway improvement projects which can include additional lanes, pavement improvements, and intelligent transportation systems. These projects can reduce the travel time and also improve the travel time reliability. An example of this is shown in Figure 2.



**FIGURE 1. Delay Calculation**





**FIGURE 2.** Travel Time Average and Reliability Improvements

**TABLE 1. Performance Measures of Interest**

PERFORMANCE MEASURE	Description
<b>DELAY</b>	Delay is calculated by taking the difference between actual speeds when they fall below 60 MPH and the posted speed limit. This is to take out the delay caused by the lower average speeds from commercial vehicles.
<b>DELAY INDEX</b>	Delay index is calculated by adding the delay if a probe vehicle drove every segment of roadway once every ten minutes. This value is then divided by the length of the roadway segment. This allows users to make comparisons between varying corridors and locate areas that cause the most delay.
<b>MAXIMUM DELAY</b>	Maximum delay is the maximum calculated delay per segment throughout a year.
<b>AVERAGE SPEED</b>	Average speed is determined by calculating the space mean speed of the worst ranked hour in the weekday AM peak (6:00 AM - 9:00 AM) and weekday PM peak (3:00 PM - 7:00 PM) periods for each segment of roadway. This is compared to the space mean speed of the previous five year period for the same hour.
<b>CONGESTION SEVERITY</b>	Congestion severity is calculated based on the worst hourly average speed experienced during the AM or PM peak period per traffic message channel (TMC) segment. A TMC segment is a standard for delivering real-time traffic information. They vary from tenths of a mile long to several miles long.
<b>TRAVEL TIME RELIABILITY</b>	Travel time reliability is a measure of travel time consistency over a period of time. When travel times are unreliable, customers are more likely to experience unexpected delays. Travel times are shown to be reliable when the 95 <sup>th</sup> percentile travel time remains close to the average travel time.
<b>AVERAGE TRAVEL TIME</b>	The amount of time a customer should budget to be on-time on average.
<b>95TH PERCENTILE TRAVEL TIME</b>	The amount of time a customer should budget to be on-time 19 out of 20 days (95% of the time). The 95 <sup>th</sup> percentile travel time is also known as the planning time.
<b>LEVEL OF TRAVEL TIME RELIABILITY</b>	Level of travel time reliability (LOTTR) is calculated as the ratio of the 80 <sup>th</sup> percentile travel time to a “normal” travel time (50 <sup>th</sup> percentile). LOTTR measures the consistency and dependability of road segments. The Federal Highway Administration (FHWA) deemed a road segment to be unreliable if its LOTTR value exceeds 1.50.

*Note: May 1<sup>st</sup> through September 30<sup>th</sup> were used for the summer reliability calculations.*





## PERFORMANCE MEASURES VISUALIZATIONS

Performance measures visualizations provide an easy way to graphically represent the performance metrics listed above. In this report, five main visualizations are used. These five visualizations are explained in detail below.

### DELAY INDEX

Figure 3 is an example of the delay index graph. This figure represents I-75 through Oakland County in the Metro Region. The delay index visualization displays which months are incurring the most delay, while comparing how delay patterns change from year-to-year. Figure 3 shows the following:

- a) Yearly delay index per mile totals (in minutes).
- b) Delay index per mile (in minutes).
- c) Month of year.
- d) Higher than normal delay index per mile value in November 2018.
- e) A delay index per mile value of 250 minutes in February 2018.

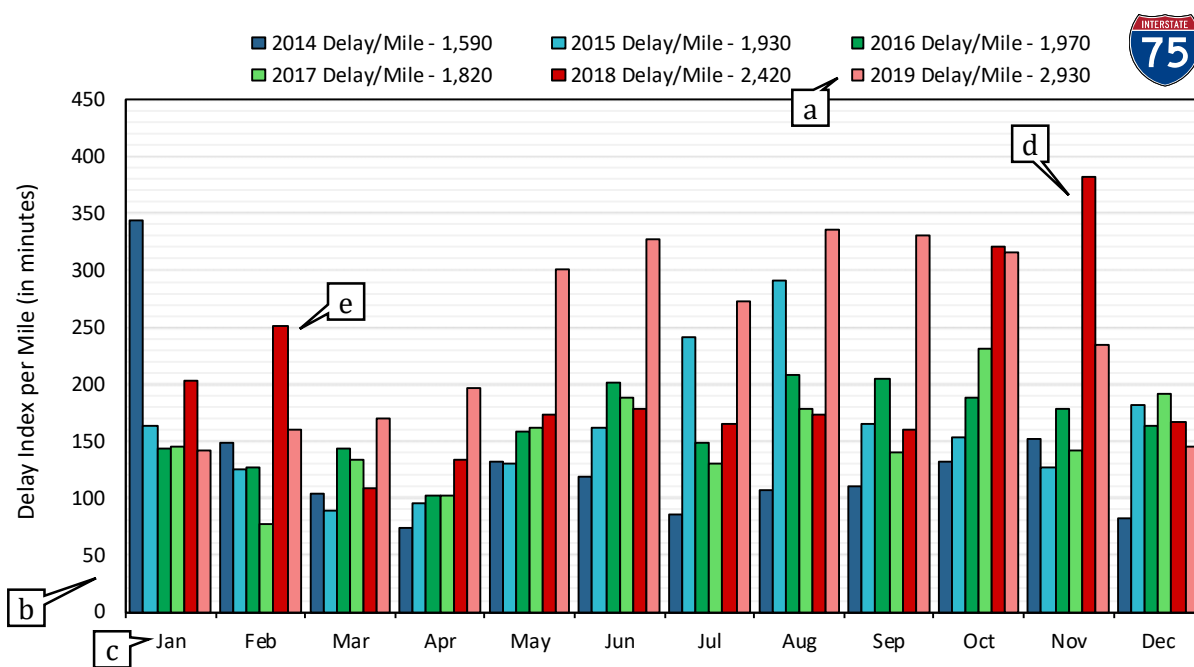


FIGURE 3. Example Delay Index Graph



## AVERAGE SPEED

Figure 4 is an example of the average speed graph. This figure represents eastbound I-94 through the Metro Region. This performance metric visualizes the speeds on a given corridor during the AM and PM peak periods, along with a 5-year historical average of those speeds. Average speed graphs can display how morning and evening peak speeds can vary by time and magnitude. The following criteria was used in the making of these graphs:

- Only weekdays (Monday – Friday) are included in the calculations.
- The AM peak hour is the worst ranked hour between 6:00 AM – 9:00 AM.
- The PM peak hour is the worst ranked hour between 3:00 PM – 7:00 PM.
- The worst ranked hour is based on the lowest average speed and minimum speed experienced during the peak hours.

Figure 4 shows the following:

- a) Legend.
- b) Location of interchanges by exit/mile marker number.
- c) Specific significant interchanges.
- d) Direction of travel.
- e) Average speed in MPH.
- f) Example of low speed area during the PM peak while approaching Metropolitan Parkway.
- g) Example of limited change in speed from year to year.
- h) 2019 PM peak average speed is approximately 50 MPH at Exit 212.
- i) Example of improvement in the current year as compared to the 5-year historical average.





## AVERAGE SPEED

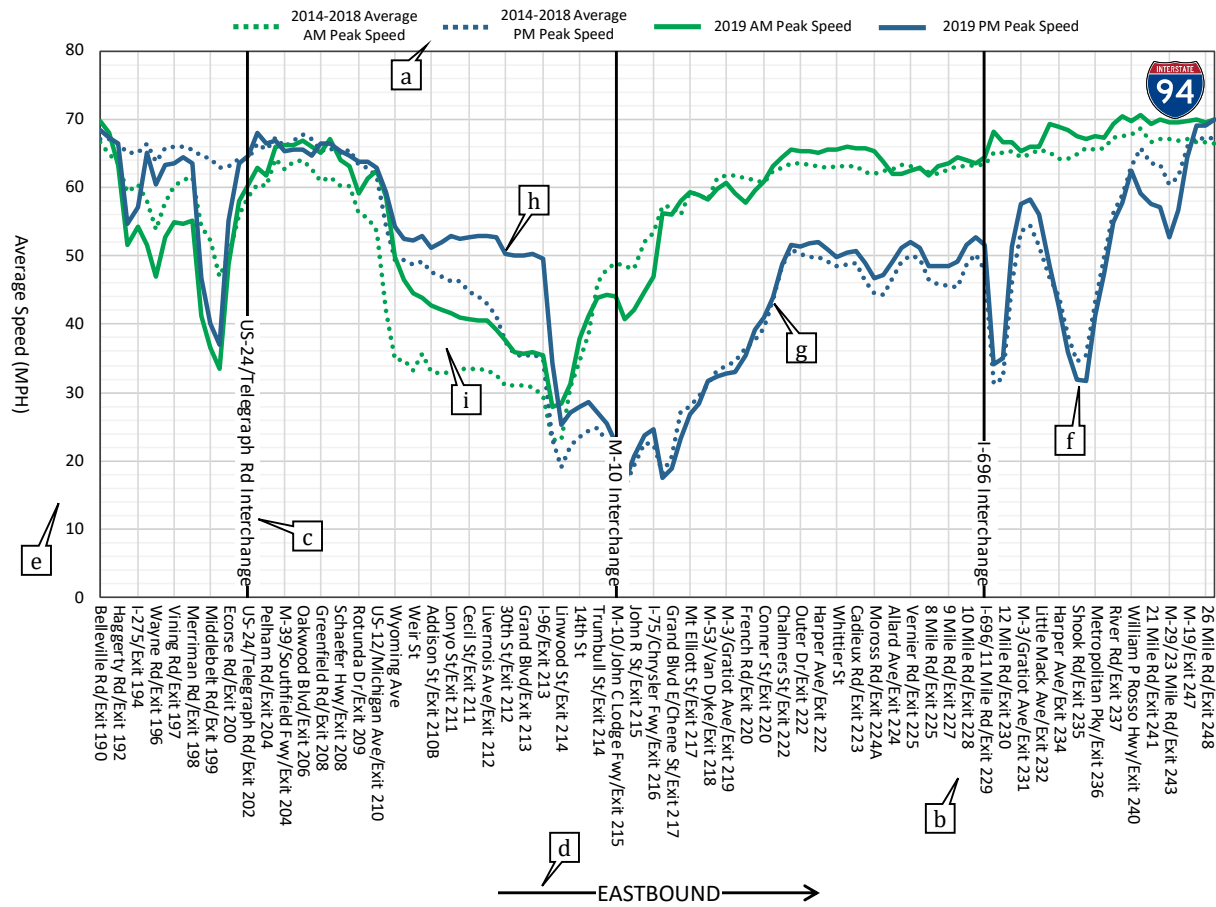


FIGURE 4. Example Average Speed Graph





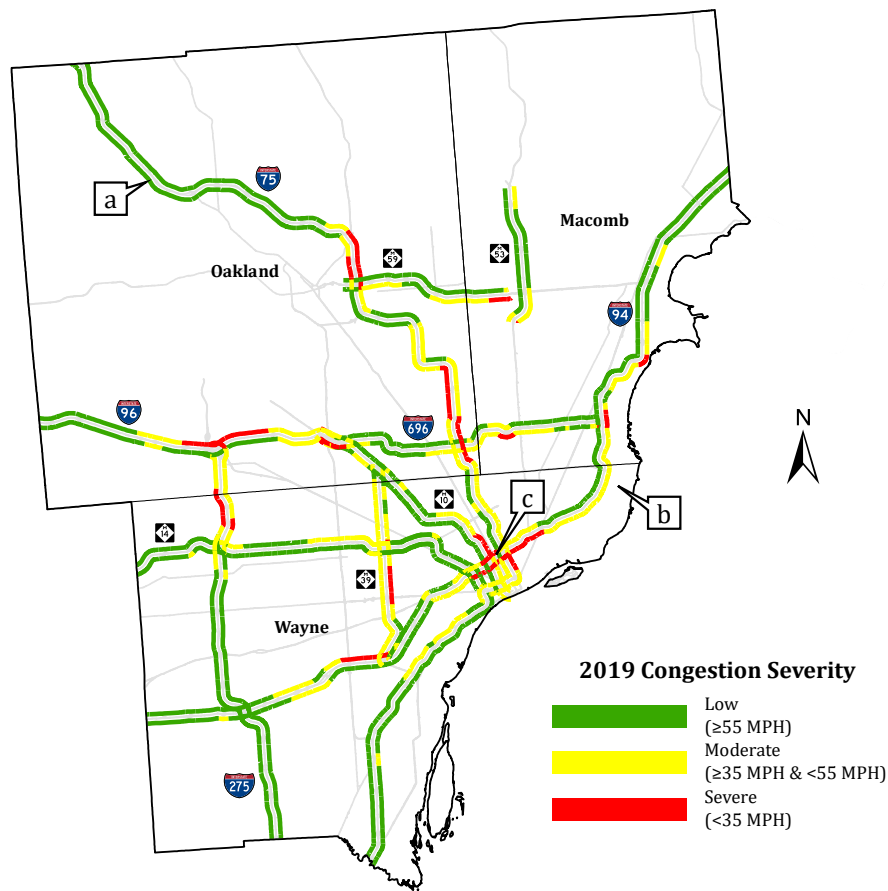
## CONGESTION SEVERITY

Figure 5 shows an example of the congestion severity map. This figure represents Metro Region during the PM peak hour. This performance metric displays the amount of congestion on corridors during AM and PM peak periods by representing speeds in a color gradient. The color gradient consists of three different categories to distinguish severity levels:

- Low ( $\geq 55$  MPH).
- Moderate ( $\geq 35$  MPH &  $< 55$  MPH).
- Severe ( $< 35$  MPH).

Figure 5 shows the following:

- a) Location of no congestion in either direction during the PM peak hour.
- b) Congestion exists only in the eastbound direction of travel from people commuting from work to home during evening hours.
- c) Location of severe congestion in both directions of travel along I-94.



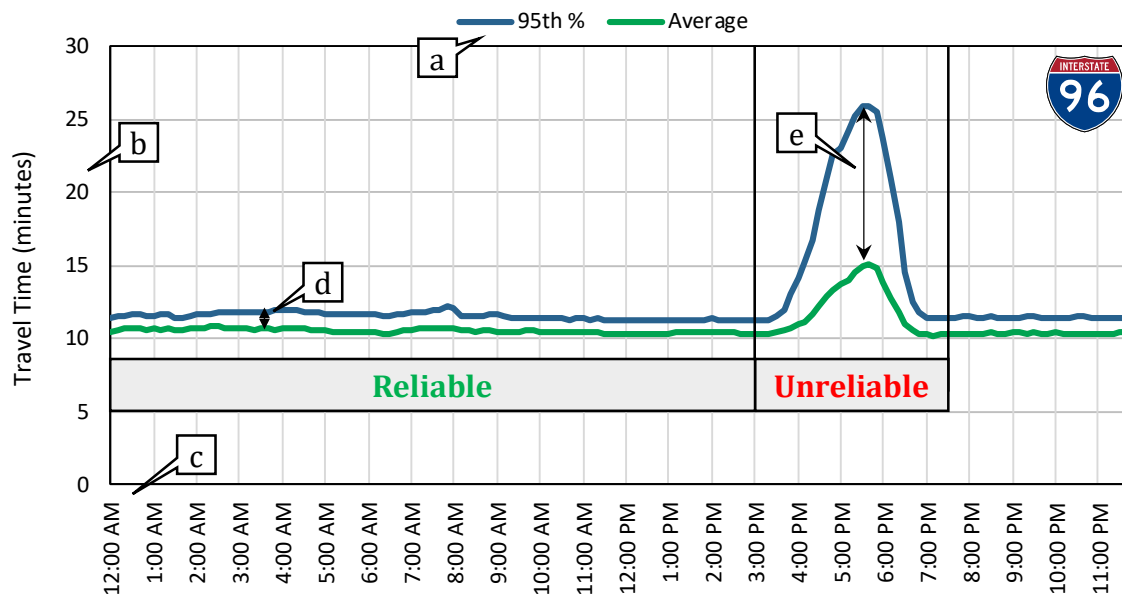
**FIGURE 5.** Example Congestion Severity Map



## TRAVEL TIME RELIABILITY

Figure 6 is an example of the travel time reliability graph. This figure represents a portion of westbound I-96 through the Metro Region. This performance metric displays the reliability of a given corridor over time. A segment is deemed “reliable” when the average and 95<sup>th</sup> percentile travel times are constant. A segment is deemed “unreliable” when the average and 95<sup>th</sup> percentile travel times differ by a large amount of time. Figure 6 shows the following:

- The 95<sup>th</sup> percentile travel time reliability and the average (50<sup>th</sup> percentile) travel time reliability.
- Amount of time it will take a vehicle to drive the entire corridor in minutes.
- Time of day.
- Small difference between average and 95<sup>th</sup> percentile travel times (reliable).
- Large difference between average and 95<sup>th</sup> percentile travel times (unreliable).



**FIGURE 6.** Example Travel Time Reliability Graph



## LEVEL OF TRAVEL TIME RELIABILITY

Figure 7 shows an example of the level of travel time reliability (LOTTR) figure. This figure represents eastbound I-96 through the Metro Region. This performance metric displays the consistency and dependability of road segments by analyzing vehicular travel times from day-to-day or across different times of the day. LOTTR is defined as the ratio between the 80<sup>th</sup>-percentile travel time to the 50<sup>th</sup>-percentile travel time. In order to determine if a road segment has reliable travel times, LOTTR utilizes a threshold value of 1.50. Therefore, a segment providing a calculated LOTTR value less than 1.50 would claim to have reliable travel times. As delegated by FHWA, the following time periods were used in the making of these graphs:

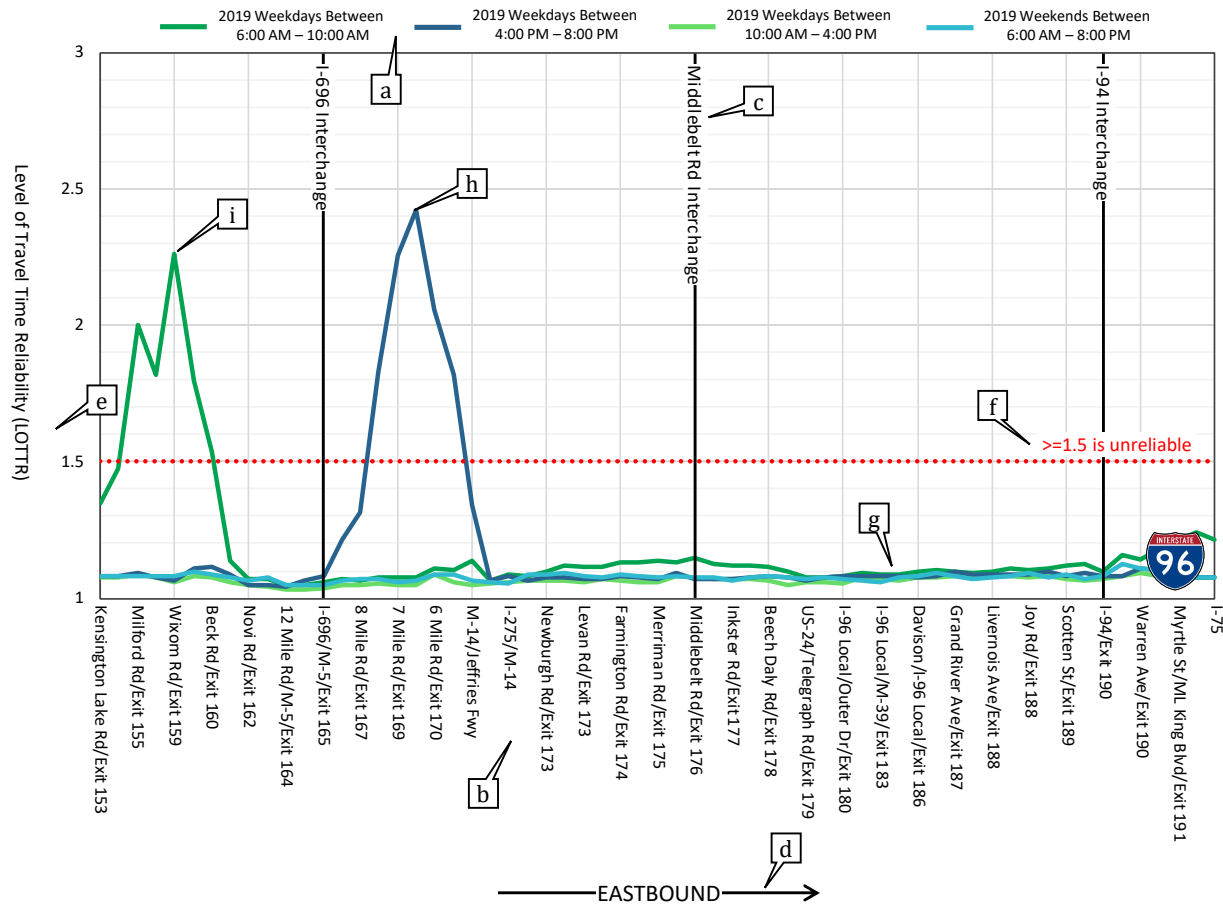
- Weekdays between 6:00 AM – 10:00 AM.
- Weekdays between 10:00 AM – 4:00 PM.
- Weekdays between 4:00 PM – 8:00 PM.
- Weekends between 6:00 AM – 8:00 PM.

Figure 7 shows the following:

- a) Legend.
- b) Location of interchanges by exit/mile marker number.
- c) Specific significant interchanges.
- d) Direction of travel.
- e) Level of travel time reliability.
- f) Threshold value of 1.50.
- g) This section of roadway has reliable travel times because the LOTTR values of the four time periods are below 1.50.
- h) Area of unreliable travel times during weekdays between 4:00 PM – 8:00 PM (PM peak).
- i) Area of unreliable travel times during weekdays between 6:00 AM – 10:00 AM (AM peak).



## LEVEL OF TRAVEL TIME RELIABILITY



**FIGURE 7. Example Level of Travel Time Reliability Figure**

Figure 8 shows an example of the level of travel time reliability map. This figure represents Metro Region during weekdays between 4:00 PM – 8:00 PM. This performance metric displays the level of travel time reliability on corridors during the four time periods mentioned above. LOTTR is represented in a color gradient that consists of three different categories to distinguish severity levels:

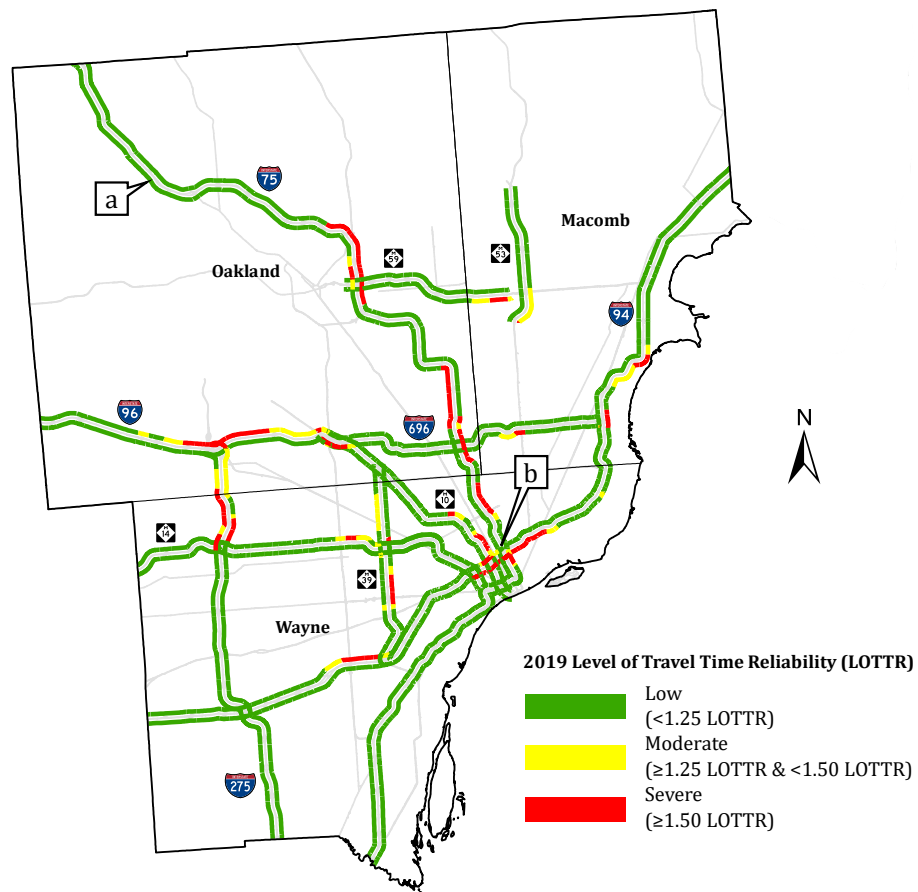
- Low (<1.25 LOTTR).
- Moderate ( $\geq 1.25$  LOTTR & <1.50 LOTTR).
- Severe ( $\geq 1.50$  LOTTR).

Figure 8 shows the following:

- Most roads outside of metro Detroit have reliable travel times because the LOTTR values are below 1.25.
- Unreliable travel times occur during weekday evenings in Detroit on I-75, I-94, and M-10.



## LEVEL OF TRAVEL TIME RELIABILITY



**FIGURE 8.** Example Level of Travel Time Reliability Map



## METRO REGION: OVERVIEW

### METRO REGION: DELAY INDEX

The following table ranks the Metro Region freeways based on the delay index. Each freeway segment is presented on a countywide or TSC basis, as appropriate.

**TABLE 2. 2019 Metro Region Delay Index Data**

Rank	Location (Route, County)	2019 Delay Index per Mile (in minutes)
1	I-94 – Detroit TSC (55 MPH)	3,961
2	I-696 – Oakland County	3,004
3	I-75 – Oakland County	2,929
4	I-96 – Oakland County	2,914
5	I-75 – Detroit TSC	2,629
6	M-59 – Oakland and Macomb County	2,569
7	M-39 – Detroit TSC and Oakland County (55 MPH)	2,410
8	I-696 – Macomb County	1,970
9	I-75 – Detroit TSC (55 MPH)	1,815
10	M-10 – Detroit TSC (55 MPH)	1,731
11	I-94 – Taylor TSC	1,596
12	I-96 – Taylor TSC	1,527
13	M-53 – Macomb County	1,514
14	M-10 – Oakland County	1,453
15	I-94 – Macomb County	1,211
16	I-96 LOCAL – Detroit TSC (55 MPH)	1,095
17	I-96 – Detroit TSC	1,020
18	I-275 – Taylor TSC	921
19	M-14 – Taylor TSC	918
20	I-75 – Taylor TSC	682





## METRO REGION: CONGESTION SEVERITY

The following tables display the amount of congestion miles per region that fall into each severity level. Table 3 shows this data during the AM peak and Table 4 shows this data during the PM peak. These tables can be utilized to compare the amount and severity of congestion across all regions. Figures 9-10 represent this information specifically in the Metro Region. Figure 9 shows the congestion severity during the AM peak and Figure 10 shows the congestion severity during the PM peak.

**TABLE 3. 2019 Congestion Miles by Severity - AM Peak**

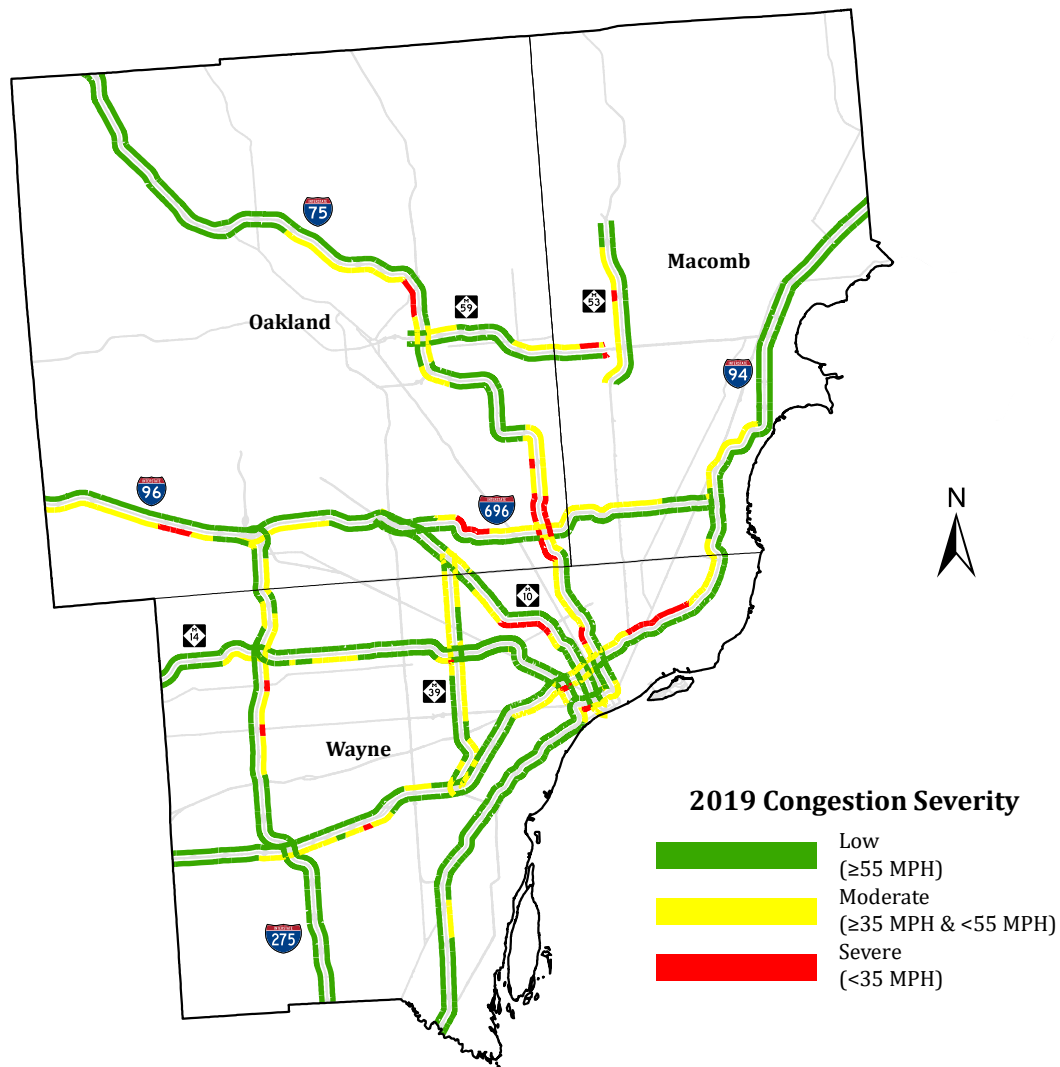
Region	Low	Moderate	Severe
Bay	751.5	0.7	0.0
Grand	667.1	31.6	5.5
<b>Metro</b>	<b>420.5</b>	<b>146.1</b>	<b>27.0</b>
North	376.8	0.2	0.0
Southwest	473.2	1.4	0.0
Superior	98.2	2.7	0.6
University	710.2	31.4	3.5
<b>Total</b>	<b>3,497.5</b>	<b>214.1</b>	<b>36.6</b>

**TABLE 4. 2019 Congestion Miles by Severity - PM Peak**

Region	Low	Moderate	Severe
Bay	745.6	6.7	0.0
Grand	642.4	51.6	10.2
<b>Metro</b>	<b>371.9</b>	<b>173.0</b>	<b>48.7</b>
North	377.0	0.0	0.0
Southwest	473.3	1.3	0.0
Superior	99.8	1.0	0.6
University	698.9	36.1	10.1
<b>Total</b>	<b>3,408.9</b>	<b>269.7</b>	<b>69.6</b>



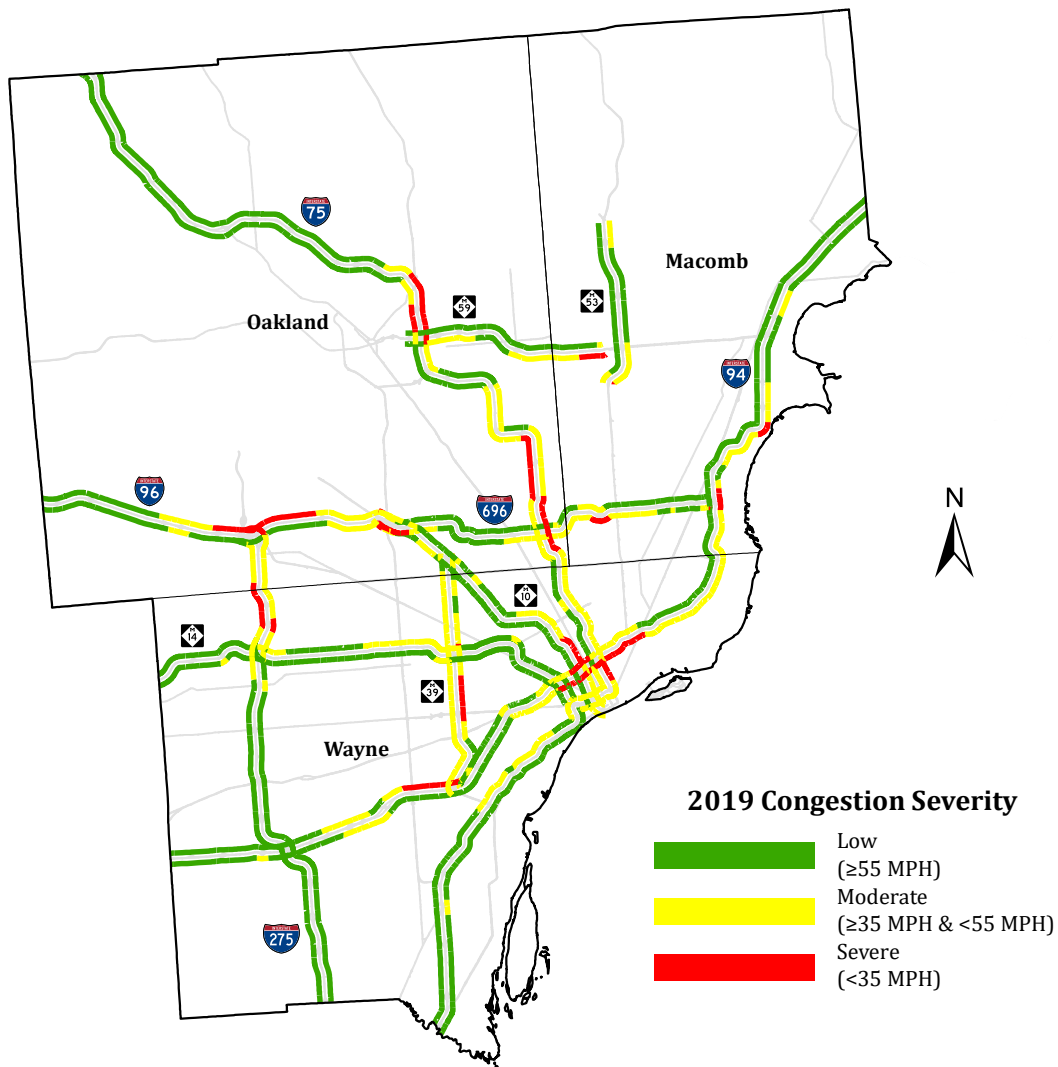
## METRO REGION: CONGESTION SEVERITY



**FIGURE 9. 2019 Metro Region AM Peak Congestion Severity**



## METRO REGION: CONGESTION SEVERITY

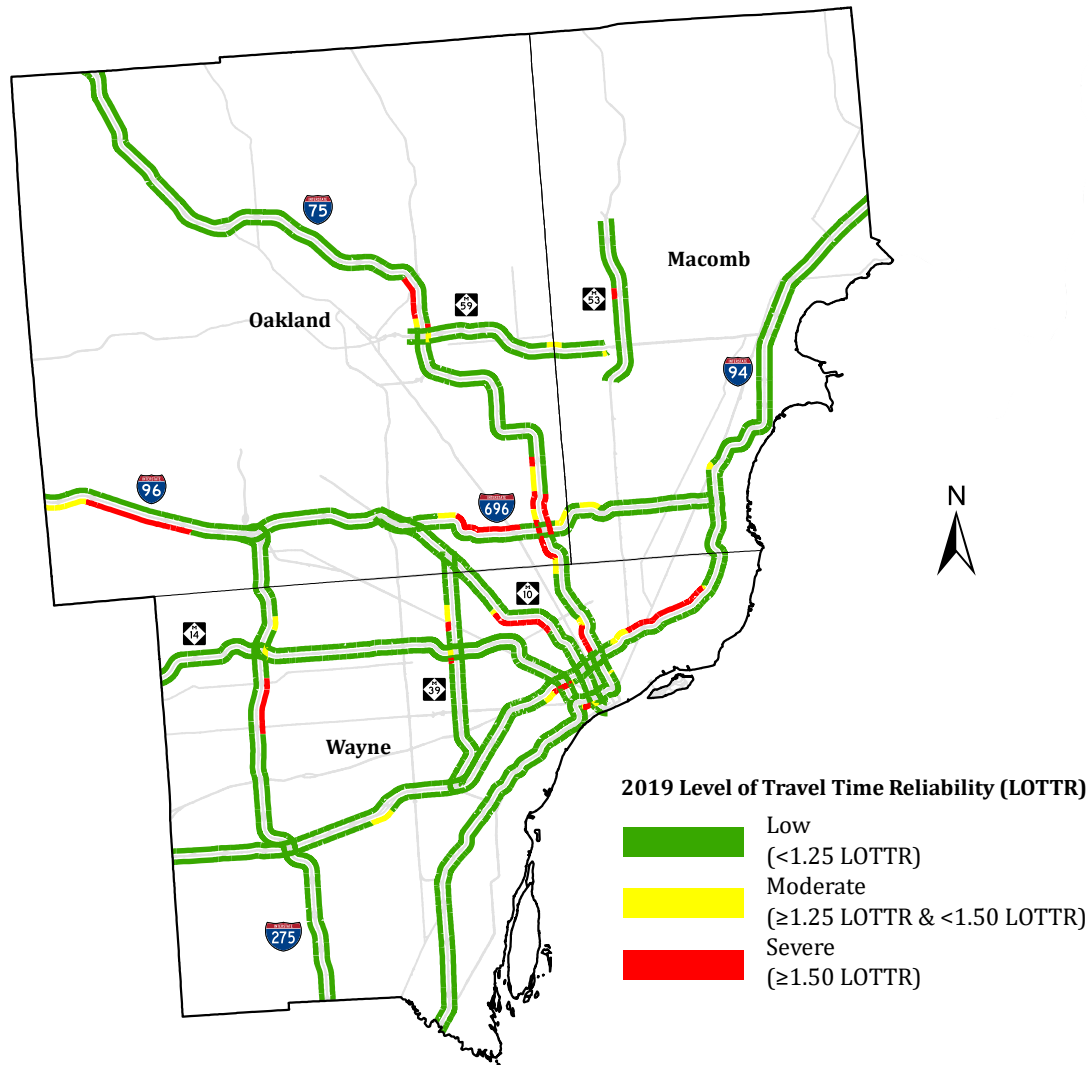


**FIGURE 10. 2019 Metro Region PM Peak Congestion Severity**



## METRO REGION: LEVEL OF TRAVEL TIME RELIABILITY

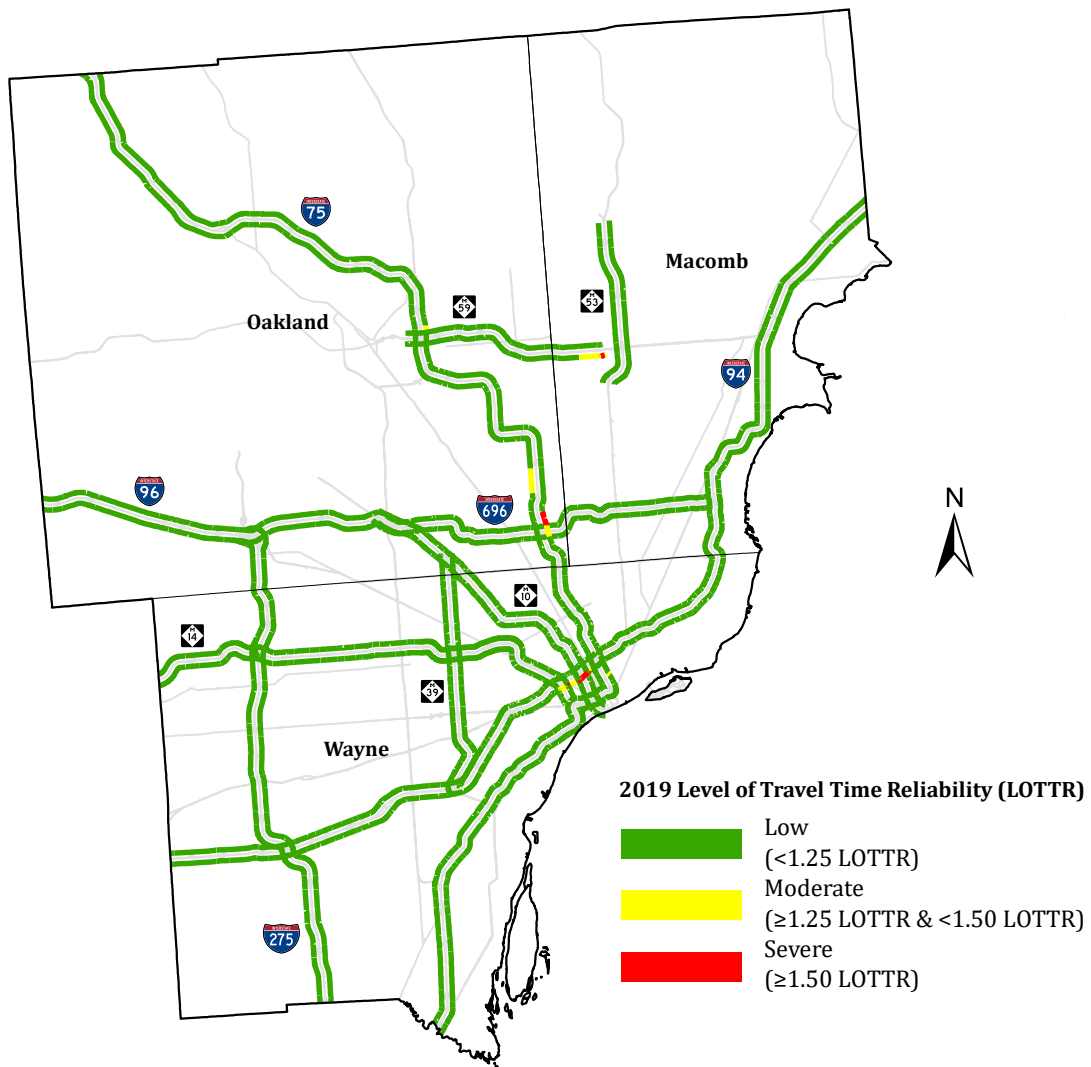
The following figures display the level of travel time reliability (LOTTR) based on severity level in the Metro Region. Figures 11-13 display the LOTTR during weekdays between 6:00 – 10:00 AM, 10:00 AM – 4:00 PM, and 4:00 PM – 8:00 PM, respectively. Figure 14 displays the LOTTR during weekends between 6:00 AM – 8:00 PM.



**FIGURE 11. 2019 Metro Region Level of Travel Time Reliability**  
(Weekdays between 6:00 AM – 10:00 AM)



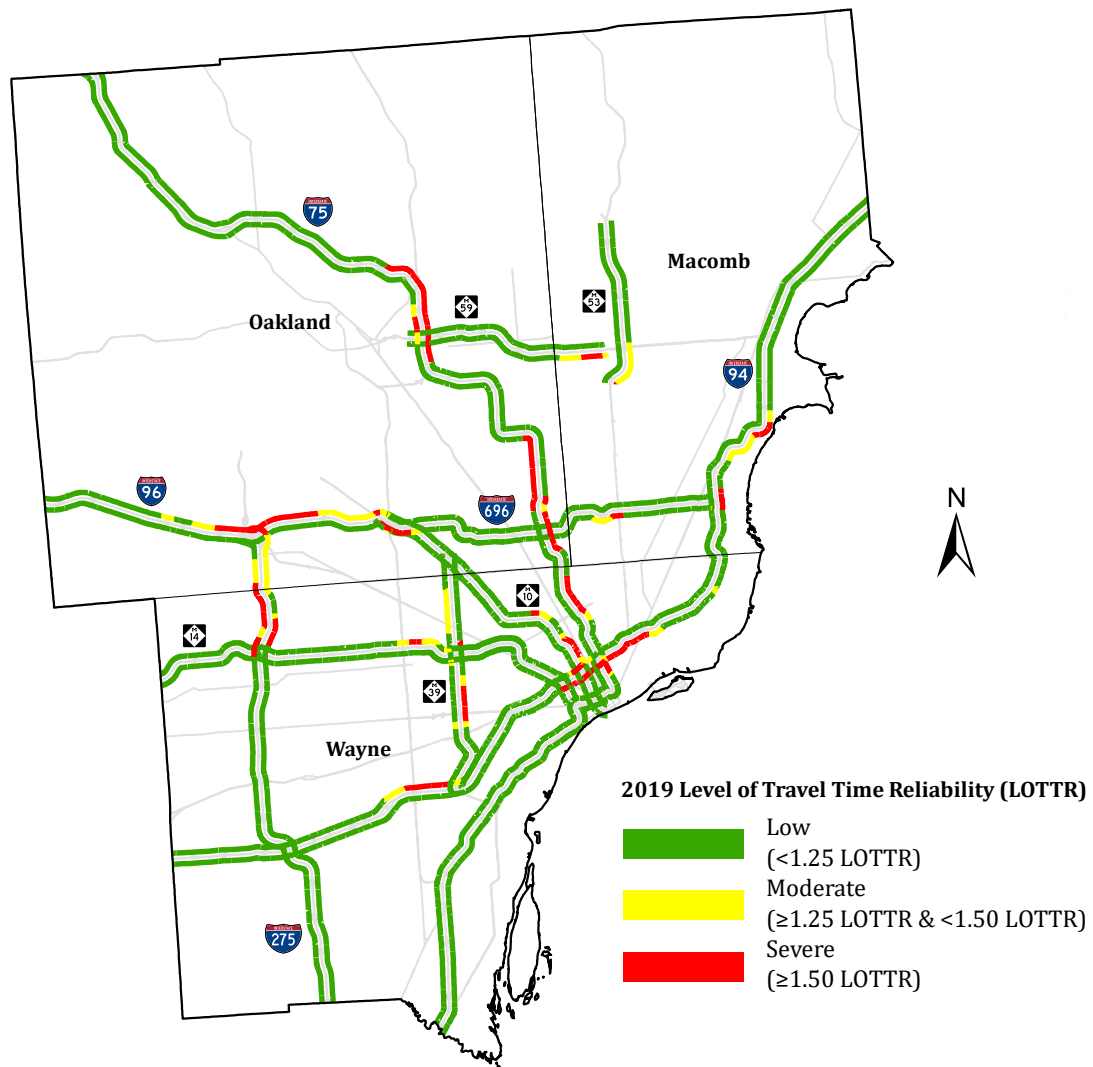
## METRO REGION: LEVEL OF TRAVEL TIME RELIABILITY



**FIGURE 12. 2019 Metro Region Level of Travel Time Reliability**  
(Weekdays between 10:00 AM – 4:00 PM)



## METRO REGION: LEVEL OF TRAVEL TIME RELIABILITY

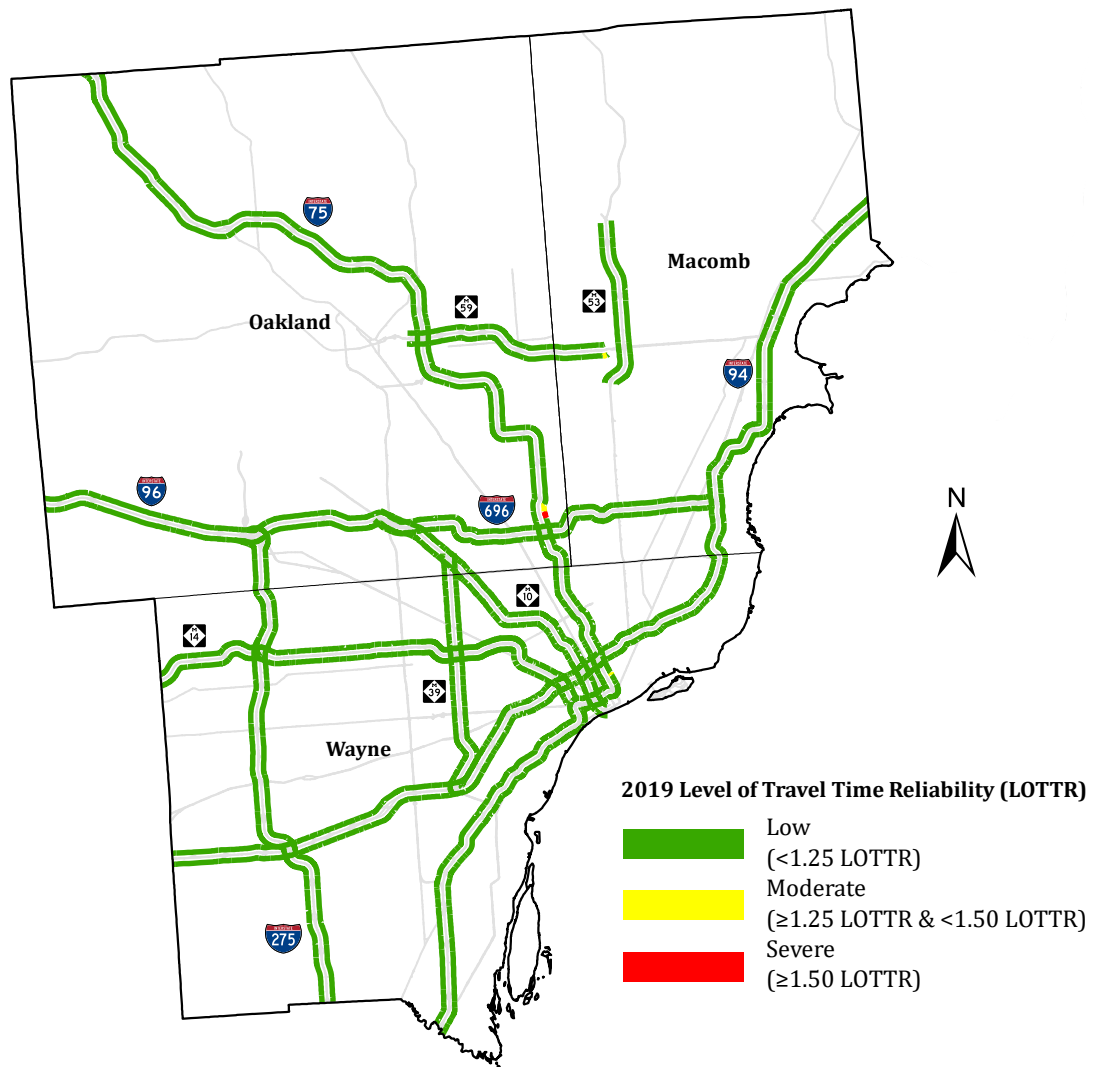


**FIGURE 13. 2019 Metro Region Level of Travel Time Reliability**  
(Weekdays between 4:00 PM – 8:00 PM)





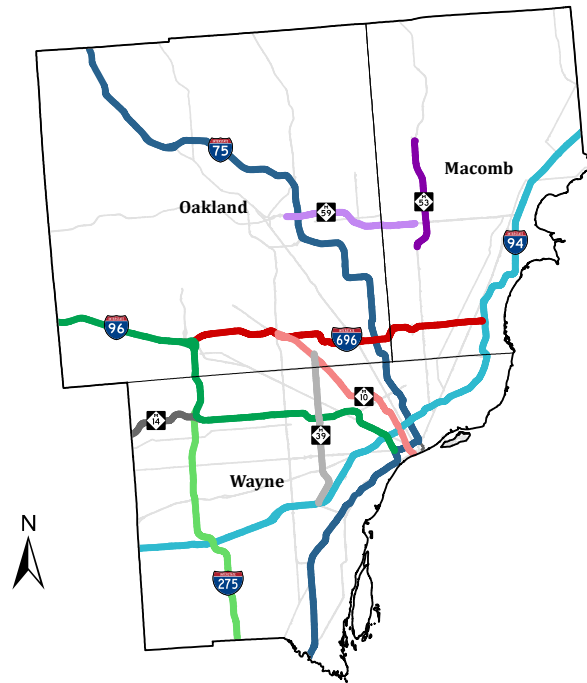
## METRO REGION: LEVEL OF TRAVEL TIME RELIABILITY







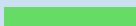



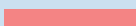







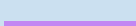



**FIGURE 14. 2019 Metro Region Level of Travel Time Reliability**  
(Weekends between 6:00 AM – 8:00 PM)



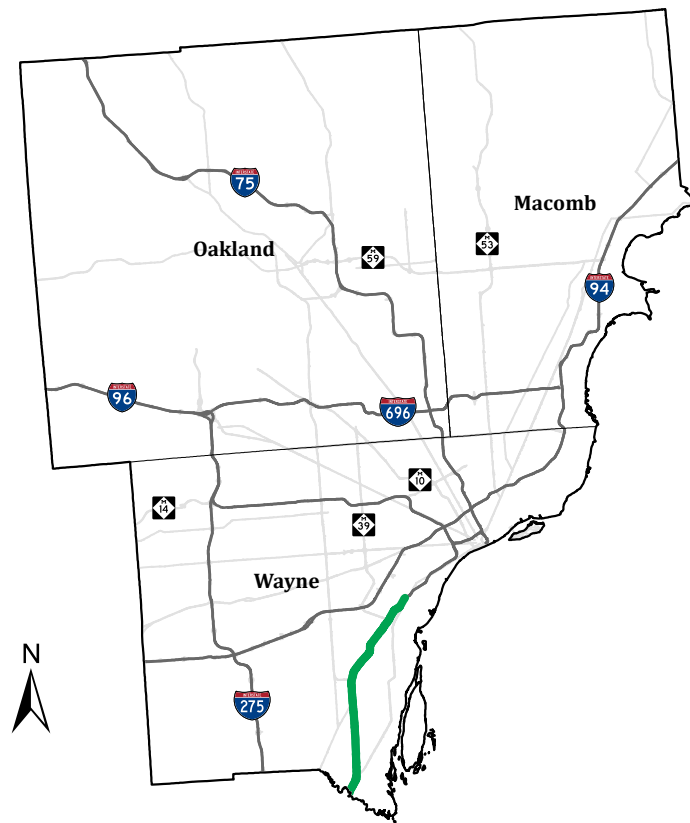
## METRO REGION: CORRIDOR GLOSSARY



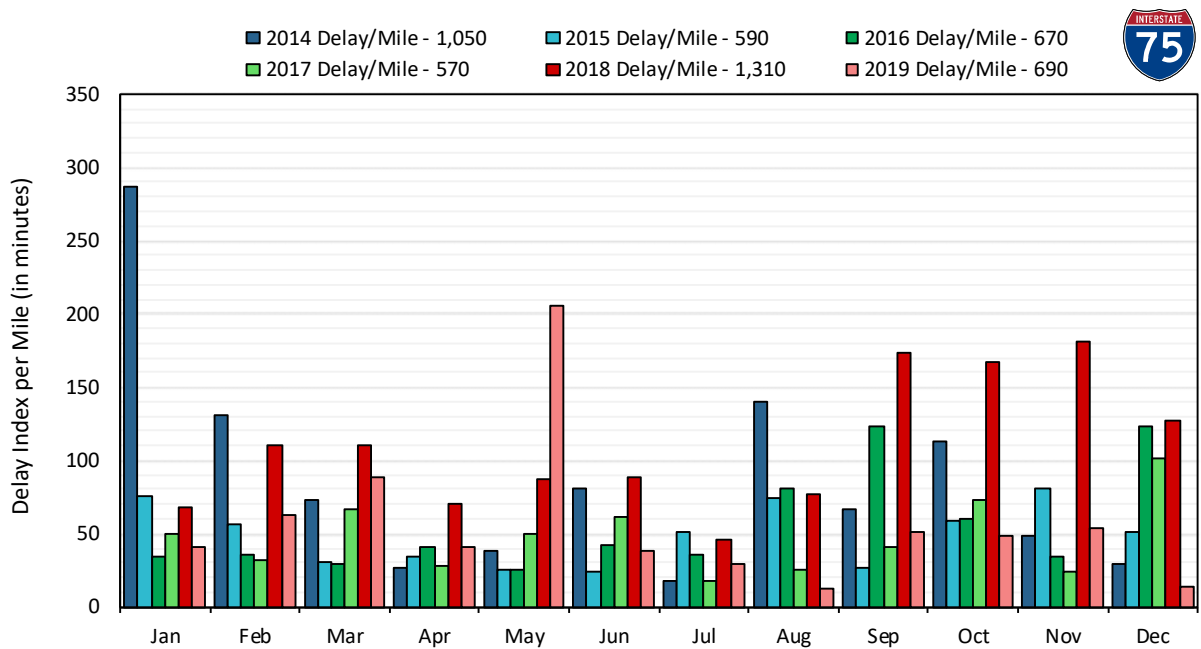
		<b>I-75: Taylor TSC, Detroit TSC (55 MPH), Detroit TSC, and Oakland</b>	<i>Pg. 25</i>
		<b>I-94: Taylor TSC, Detroit TSC (55 MPH), and Macomb</b>	<i>Pg. 39</i>
		<b>I-96 and I-96 LOCAL (55 MPH): Oakland, Taylor TSC, and Detroit TSC</b>	<i>Pg. 51</i>
		<b>I-275: Taylor TSC</b>	<i>Pg. 68</i>
		<b>I-696: Oakland and Macomb</b>	<i>Pg. 75</i>
		<b>M-10: Detroit TSC (55 MPH) and Oakland</b>	<i>Pg. 85</i>
		<b>M-14: Taylor TSC</b>	<i>Pg. 94</i>
		<b>M-39: Detroit TSC and Oakland (55 MPH)</b>	<i>Pg. 99</i>
		<b>M-53: Macomb</b>	<i>Pg. 107</i>
		<b>M-59: Oakland and Macomb</b>	<i>Pg. 114</i>



## I-75: TAYLOR TSC DELAY INDEX



a) Segment Map

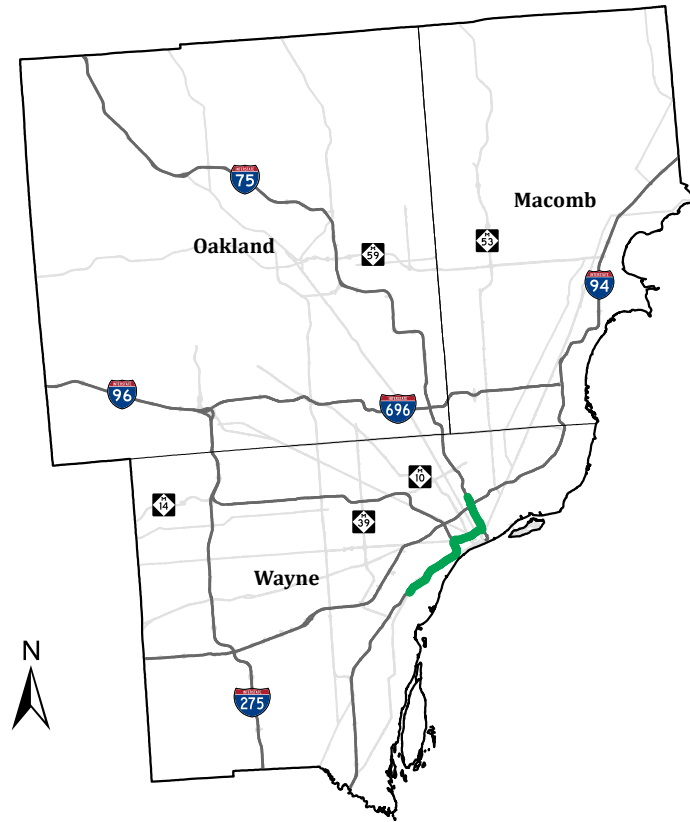


b) Delay Index Graph

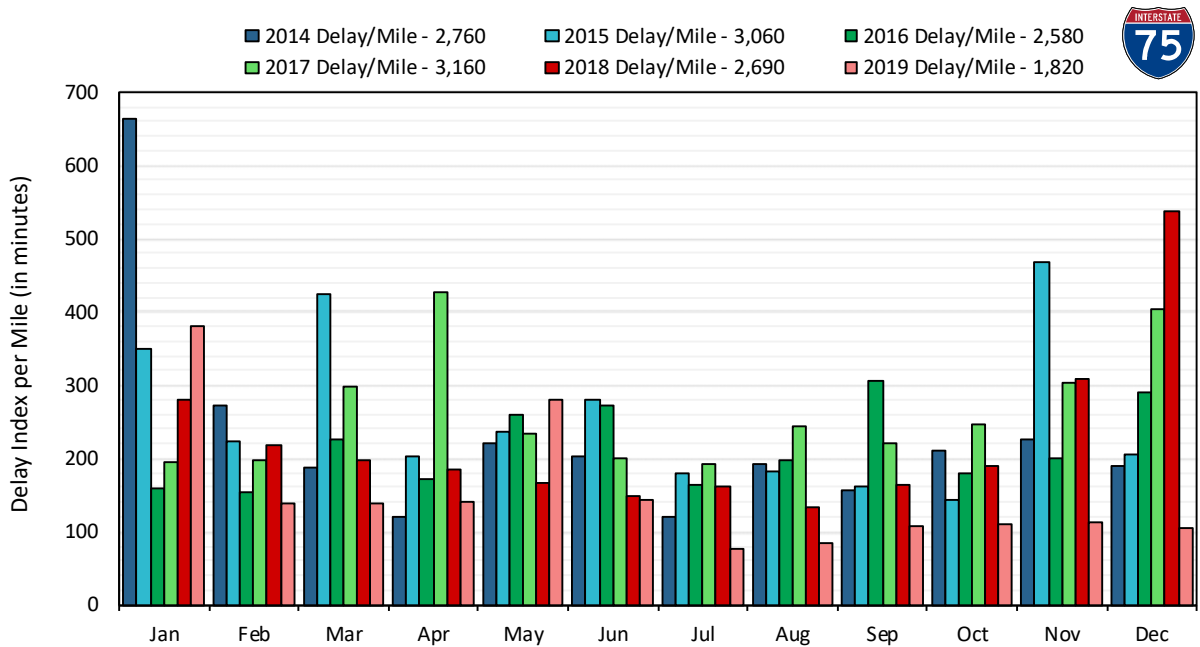
**FIGURE 15. Taylor TSC I-75 Corridor Delay Index**



## I-75: DETROIT TSC DELAY INDEX (55 MPH)



a) Segment Map

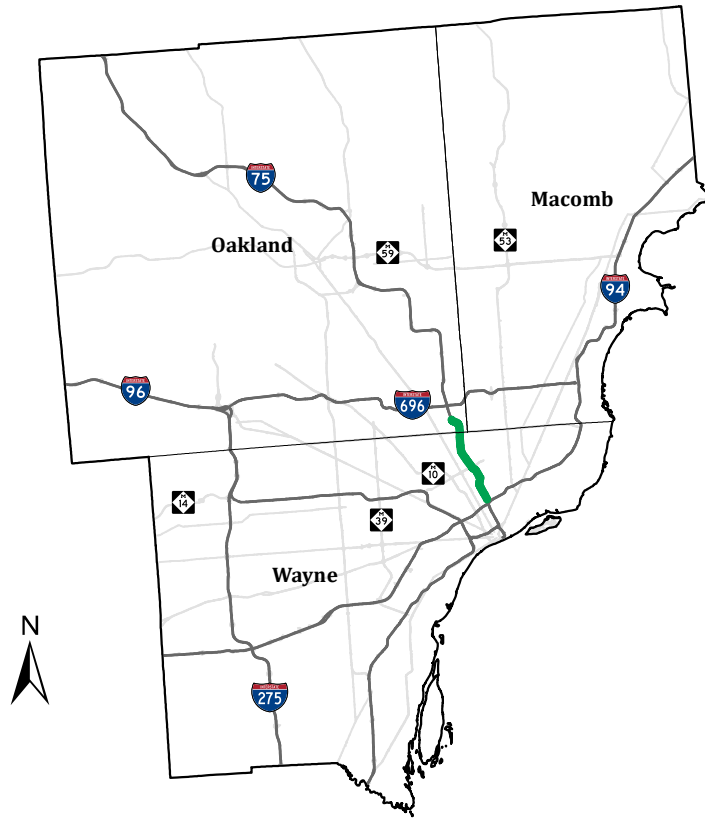


b) Delay Index Graph

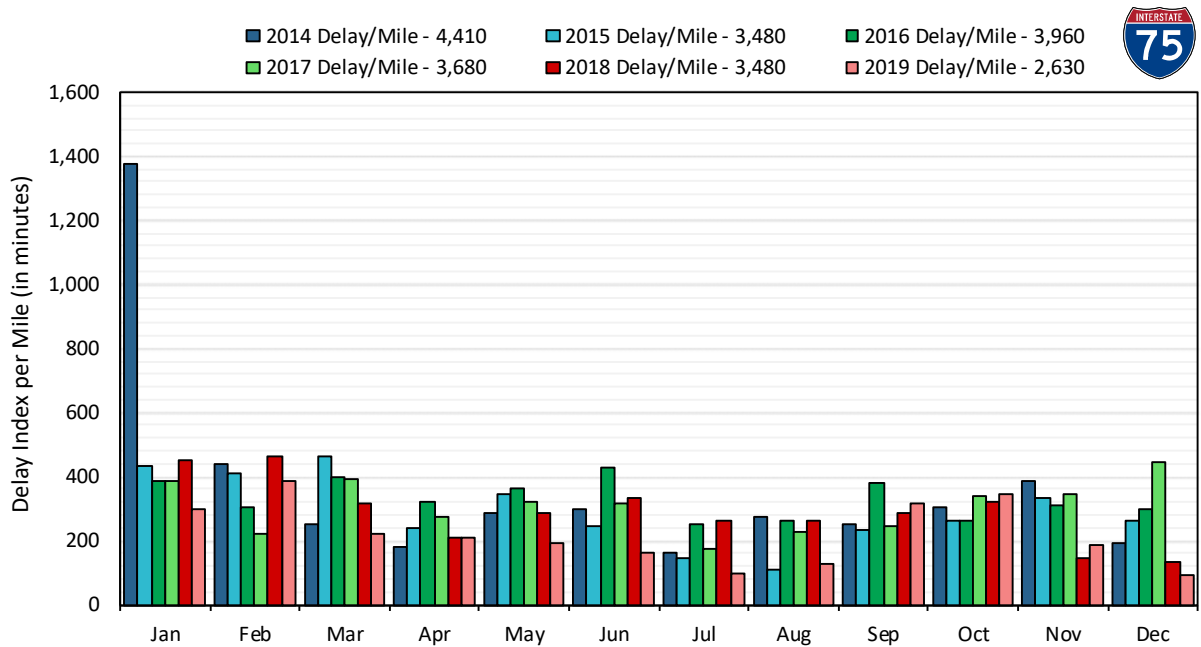
FIGURE 16. Detroit TSC (55 MPH) I-75 Corridor Delay Index



## I-75: DETROIT TSC DELAY INDEX



a) Segment Map

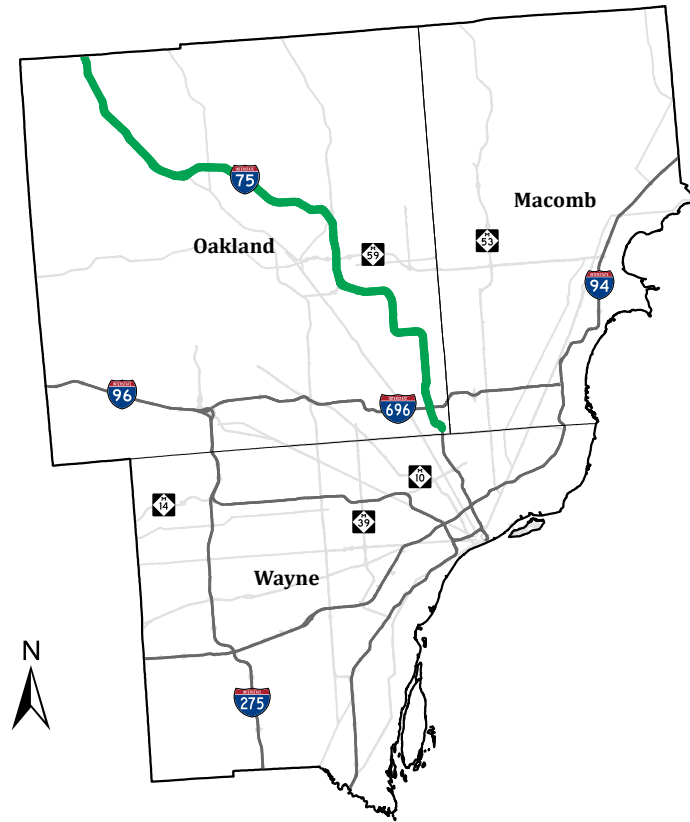


b) Delay Index Graph

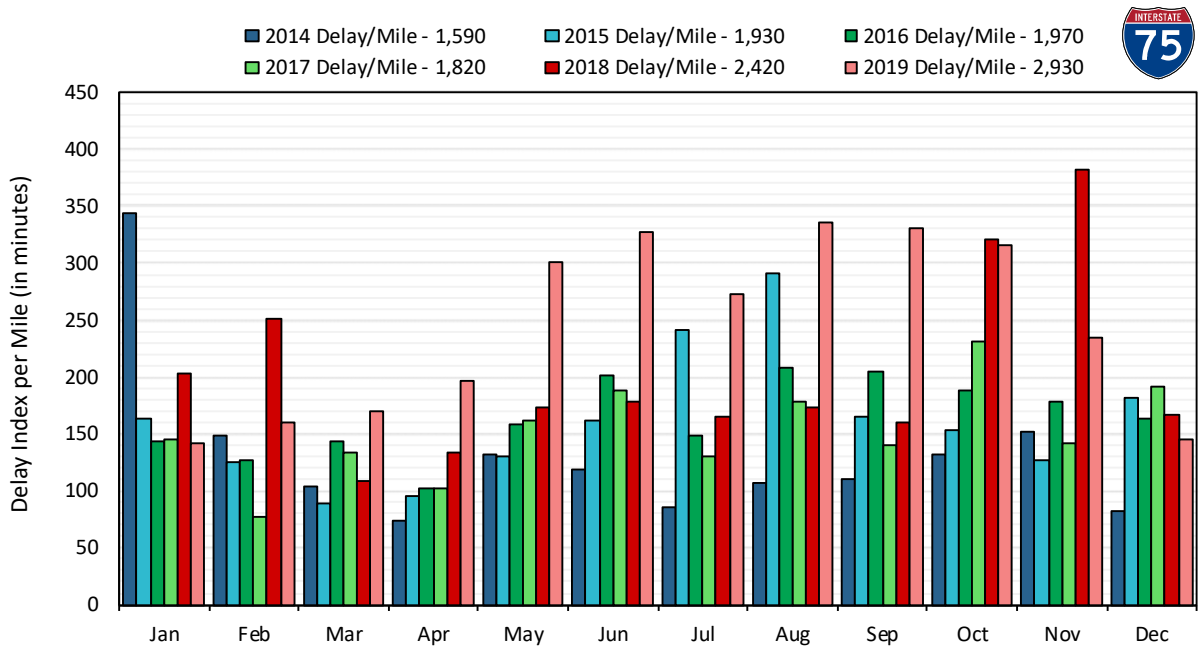
**FIGURE 17. Detroit TSC I-75 Corridor Delay Index**



## I-75: OAKLAND COUNTY DELAY INDEX



a) Segment Map



b) Delay Index Graph

FIGURE 18. Oakland County I-75 Corridor Delay Index





## I-75: AVERAGE SPEED

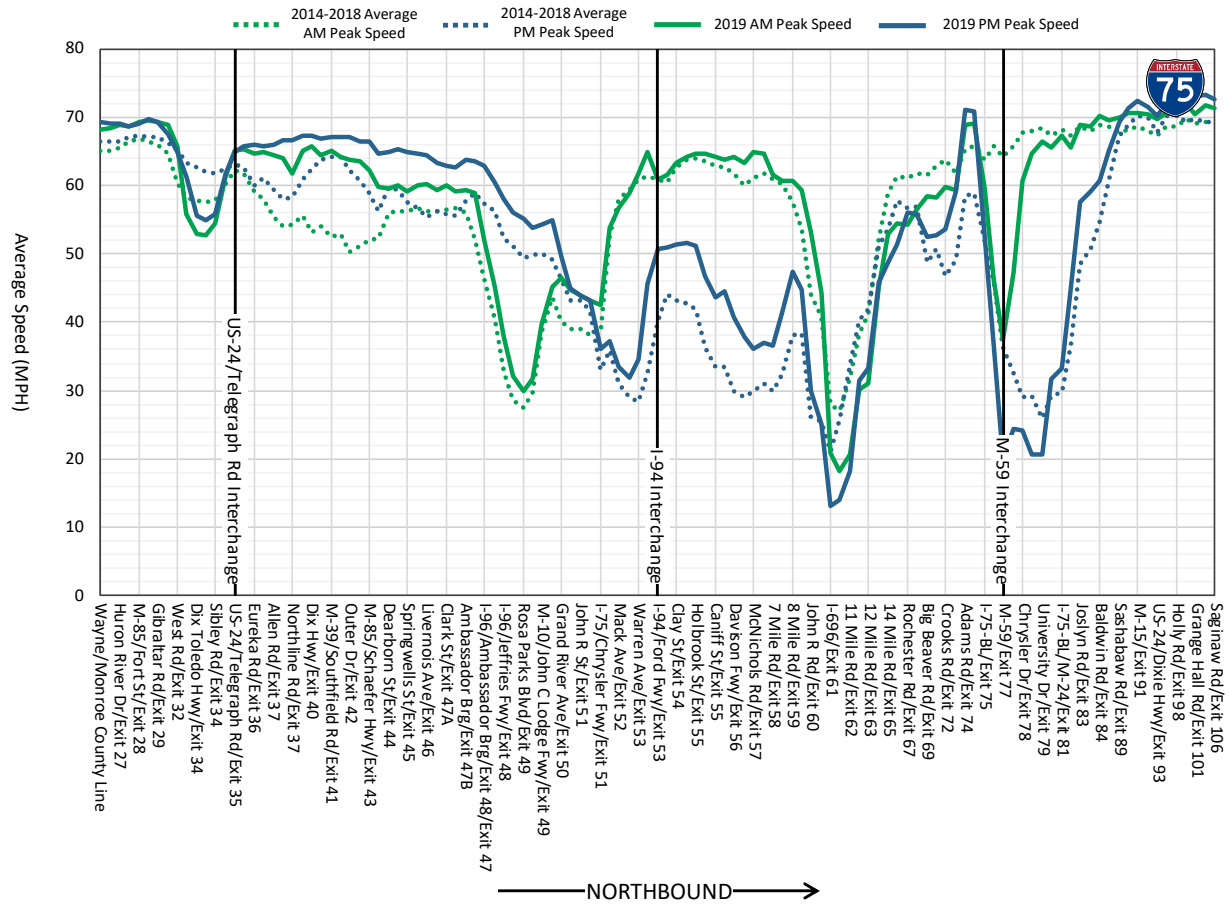


FIGURE 19. Metro Region Northbound I-75 Average Speed



## I-75: AVERAGE SPEED

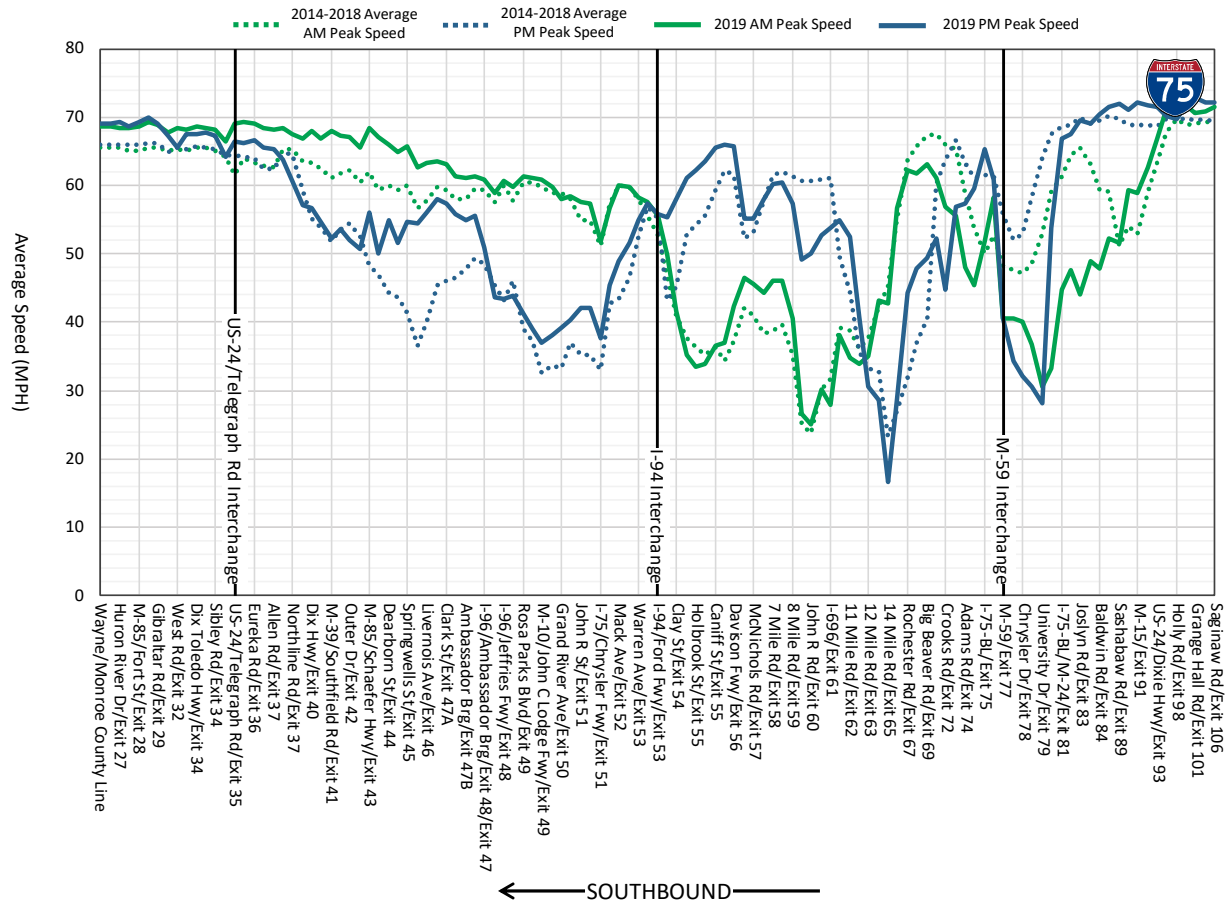


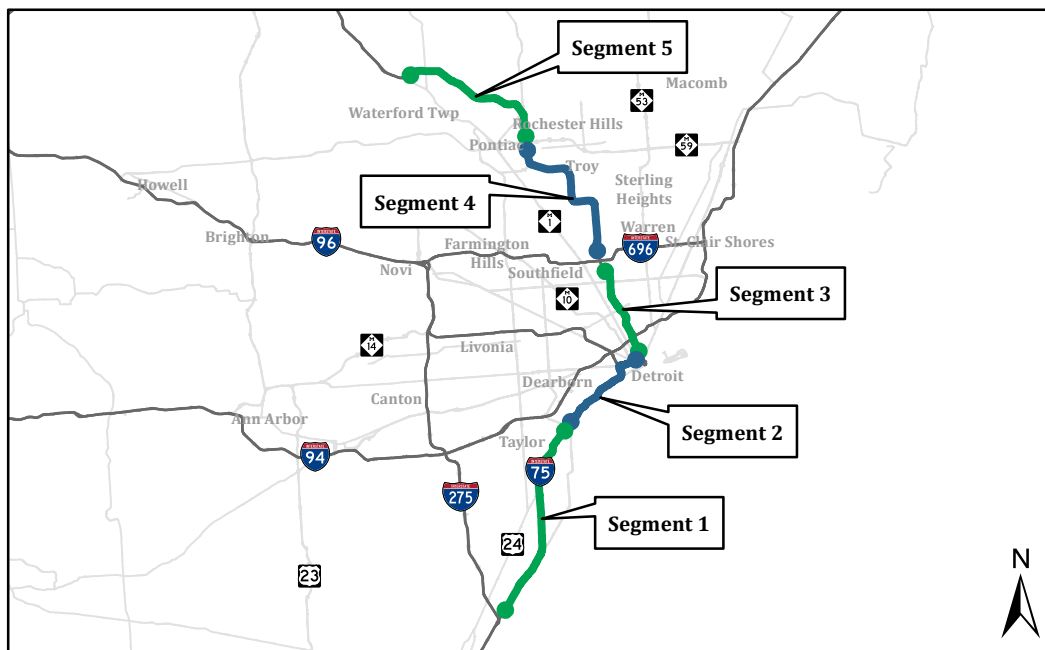
FIGURE 20. Metro Region Southbound I-75 Average Speed



## I-75: TRAVEL TIME RELIABILITY



a) Metro Region and Monroe County

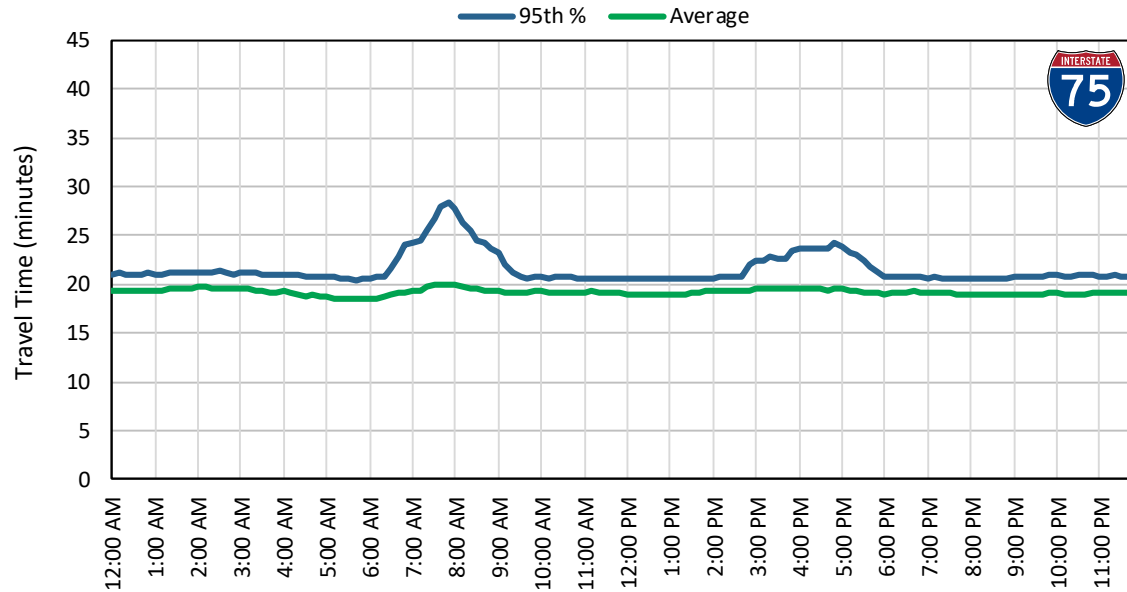


b) Detroit, Michigan

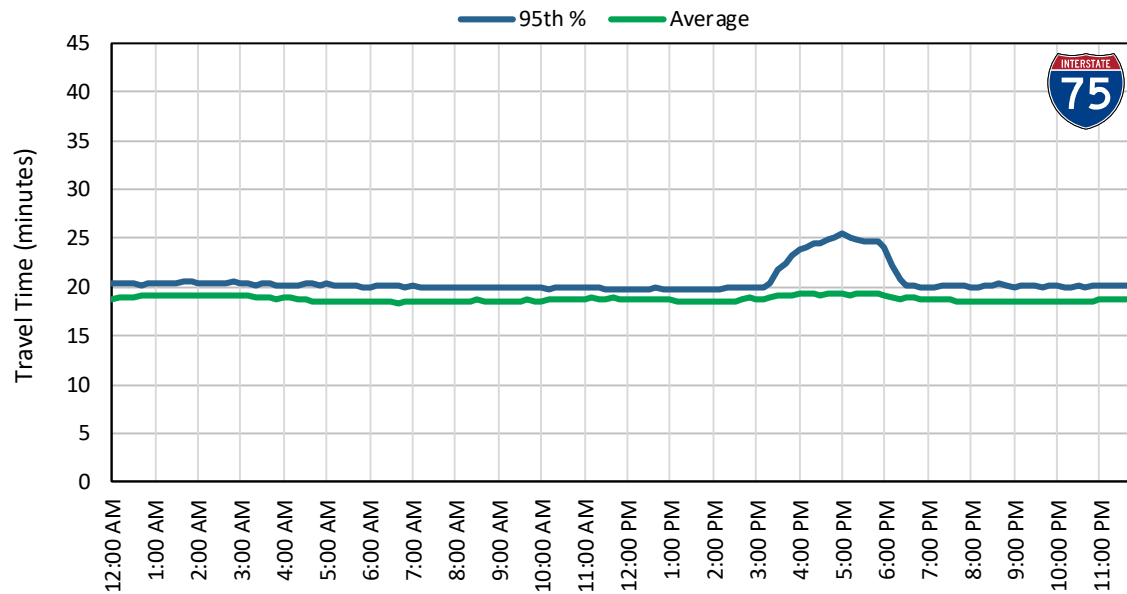
**FIGURE 21. Travel Time Reliability: I-75**



## I-75: TRAVEL TIME RELIABILITY



a) Northbound

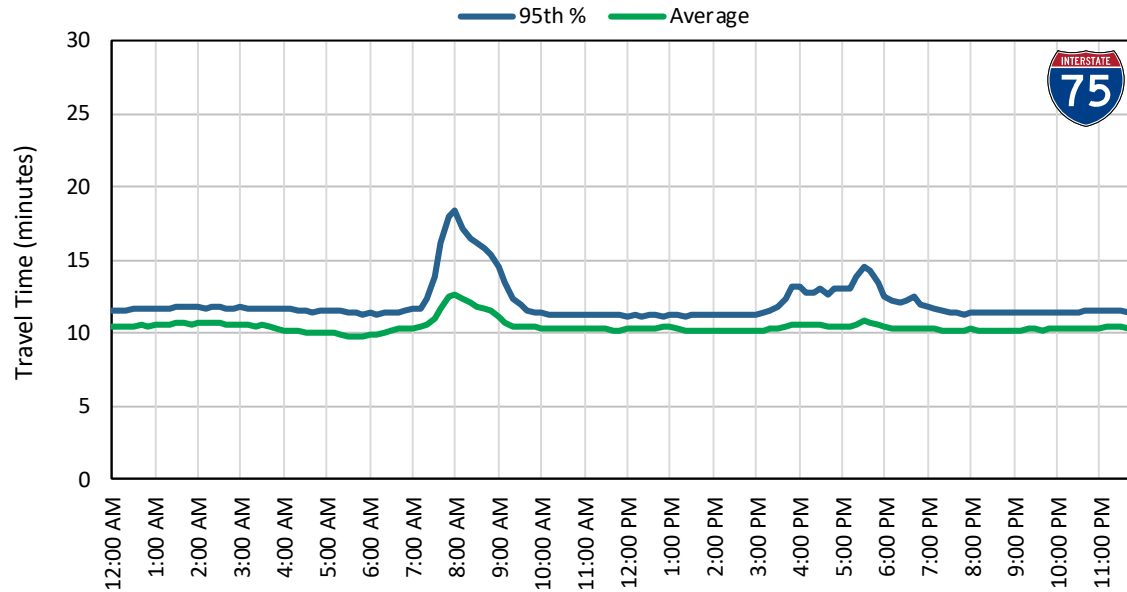


b) Southbound

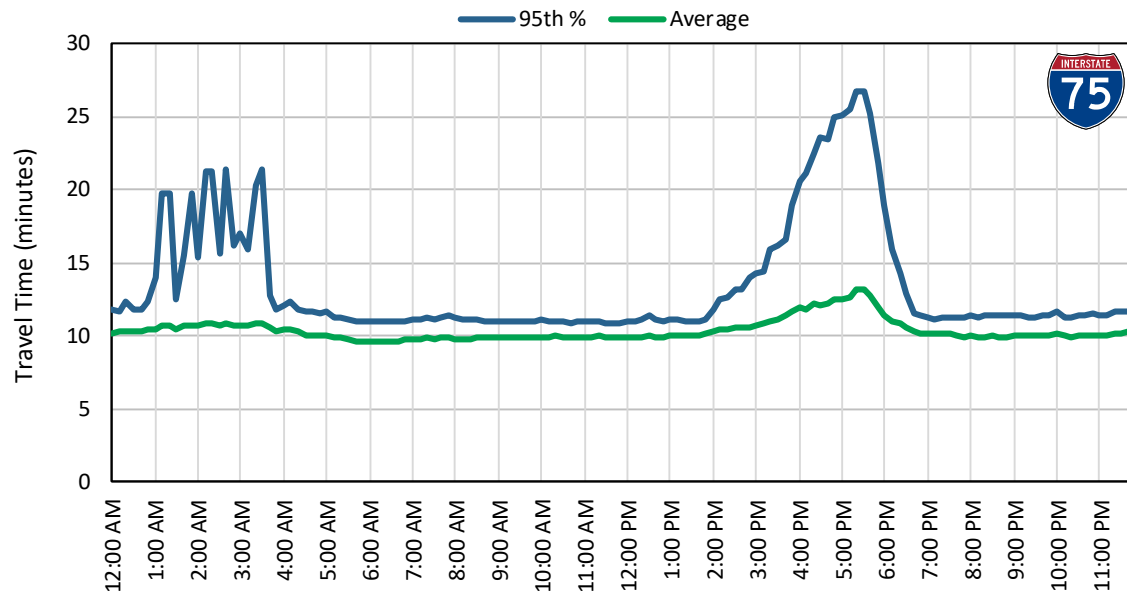
**FIGURE 22.** Segment 1 - I-75 between I-275/Exit 20 and M-39/Southfield Rd/Exit 41



## I-75: TRAVEL TIME RELIABILITY



a) Northbound

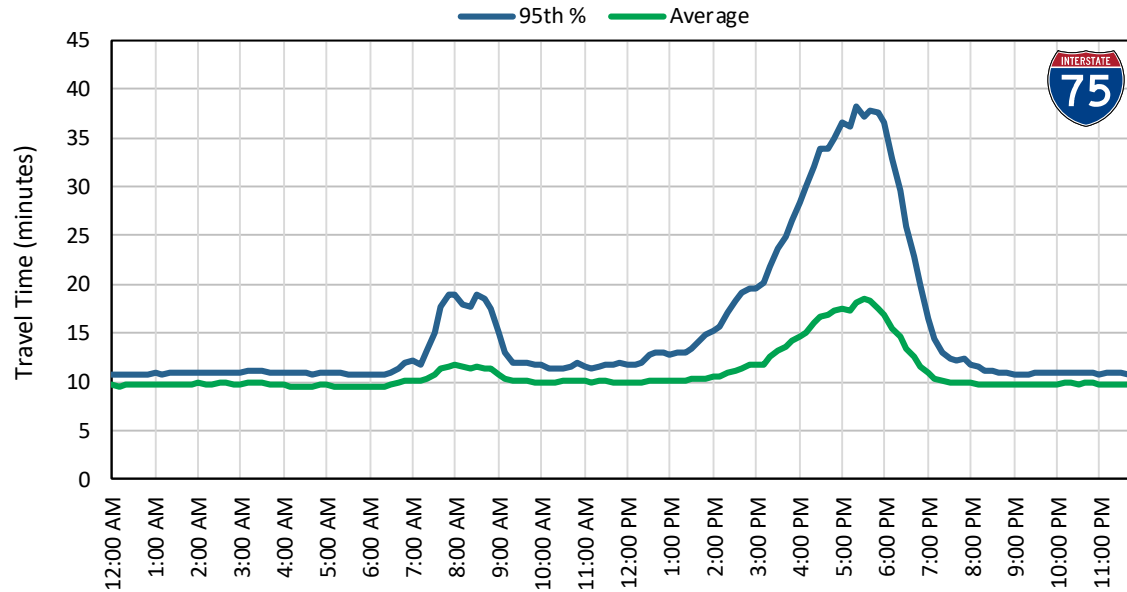


b) Southbound

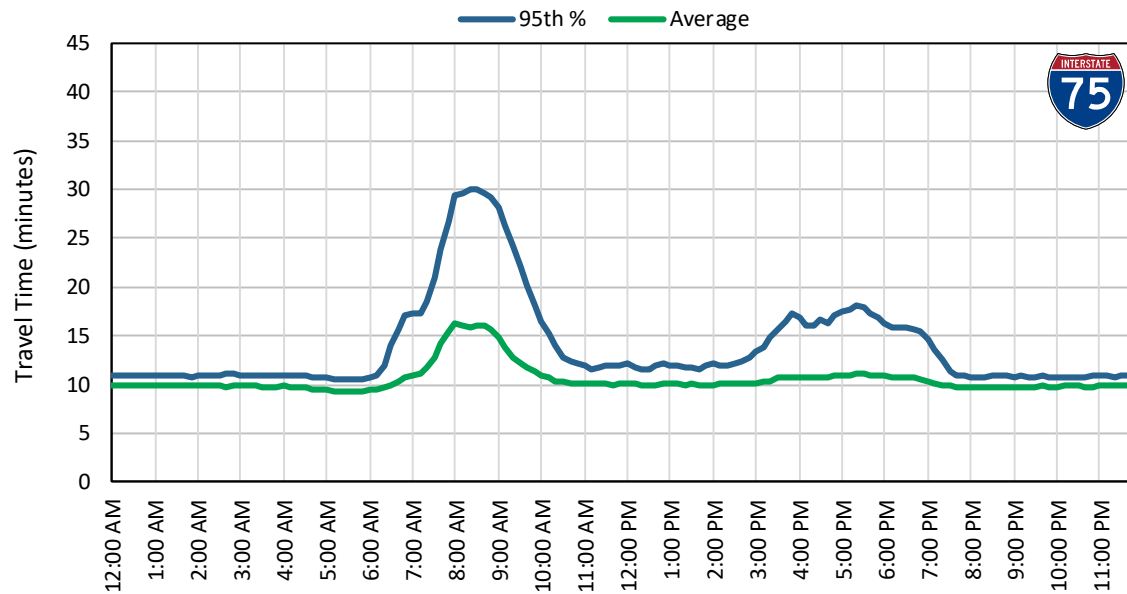
**FIGURE 23.** Segment 2 - I-75 between M-39/Southfield Rd/Exit 41 and I-75/Chrysler Fwy/Exit 51



## I-75: TRAVEL TIME RELIABILITY



a) Northbound

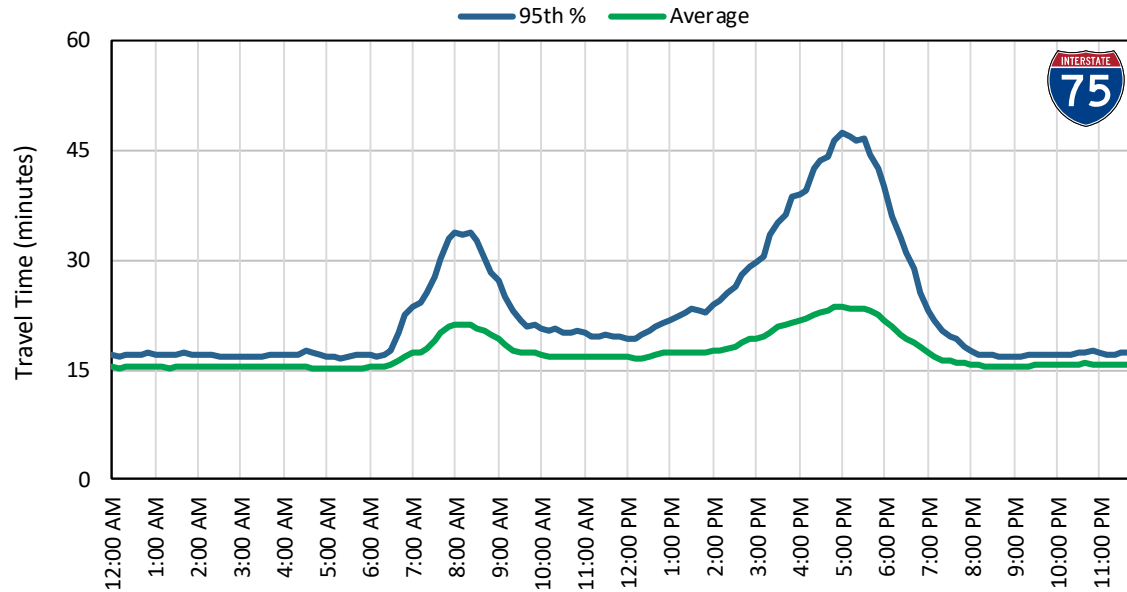


b) Southbound

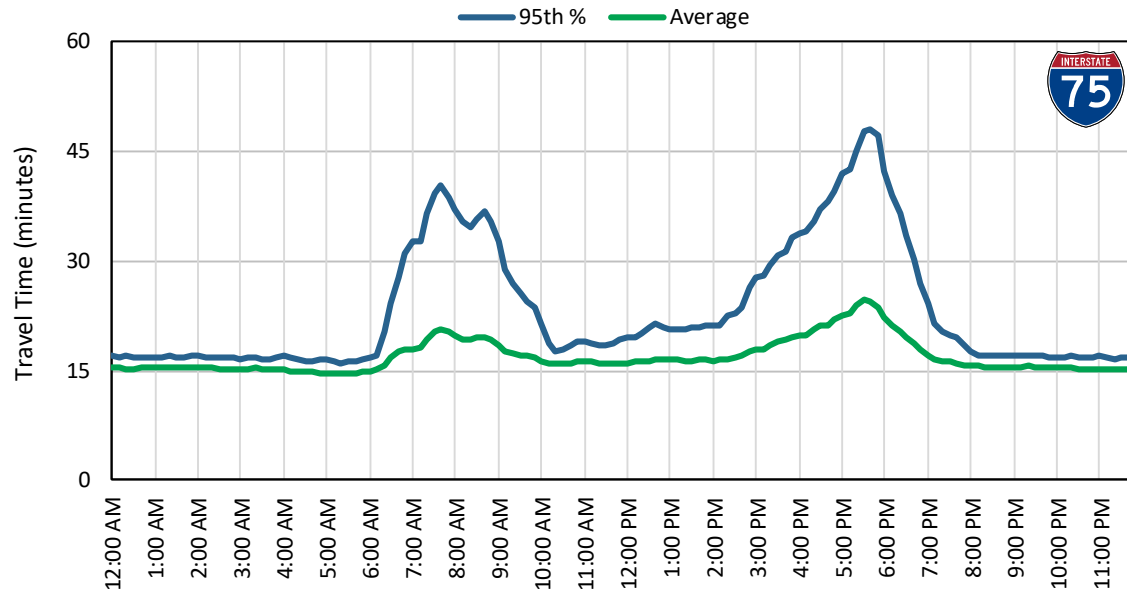
**FIGURE 24. Segment 3 - I-75 between I-75/Chrysler Fwy/Exit 51 and I-696/Exit 61**



## I-75: TRAVEL TIME RELIABILITY



a) Northbound

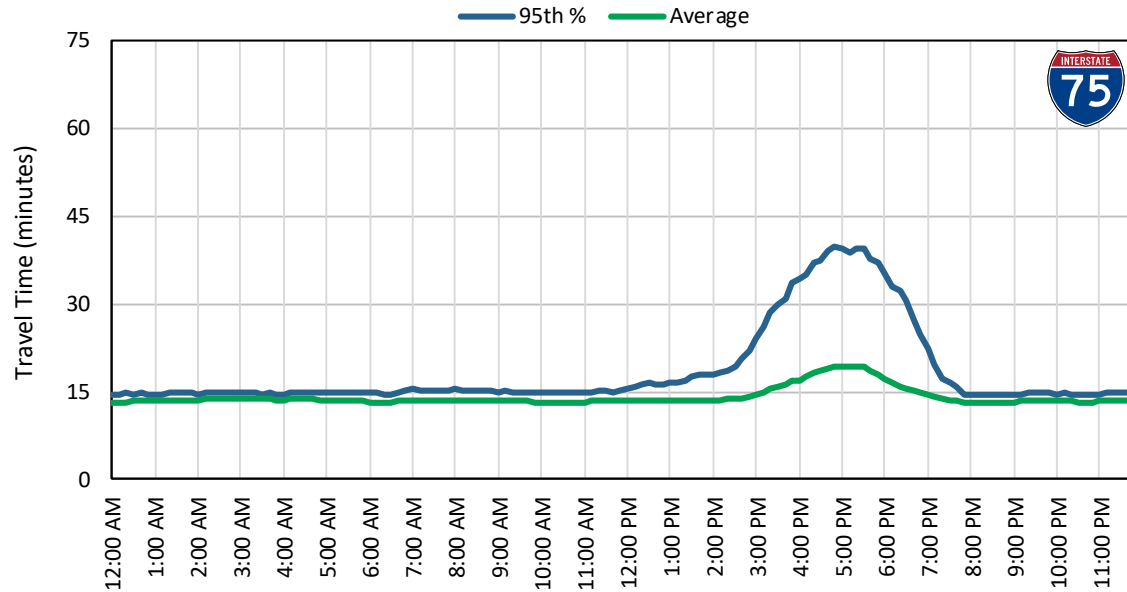


b) Southbound

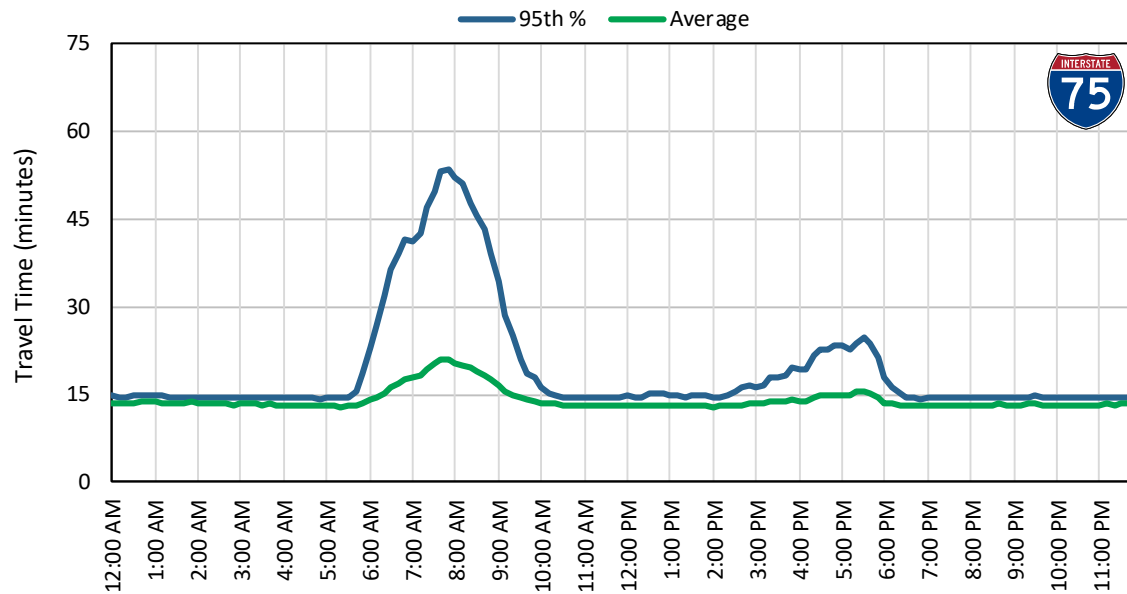
**FIGURE 25.** Segment 4 - I-75 between I-696/Exit 61 and M-59/Exit 77



## I-75: TRAVEL TIME RELIABILITY



a) Northbound



b) Southbound

**FIGURE 26.** Segment 5 - I-75 between M-59/Exit 77 and US-24/Dixie Hwy/Exit 93





## I-75: LEVEL OF TRAVEL TIME RELIABILITY

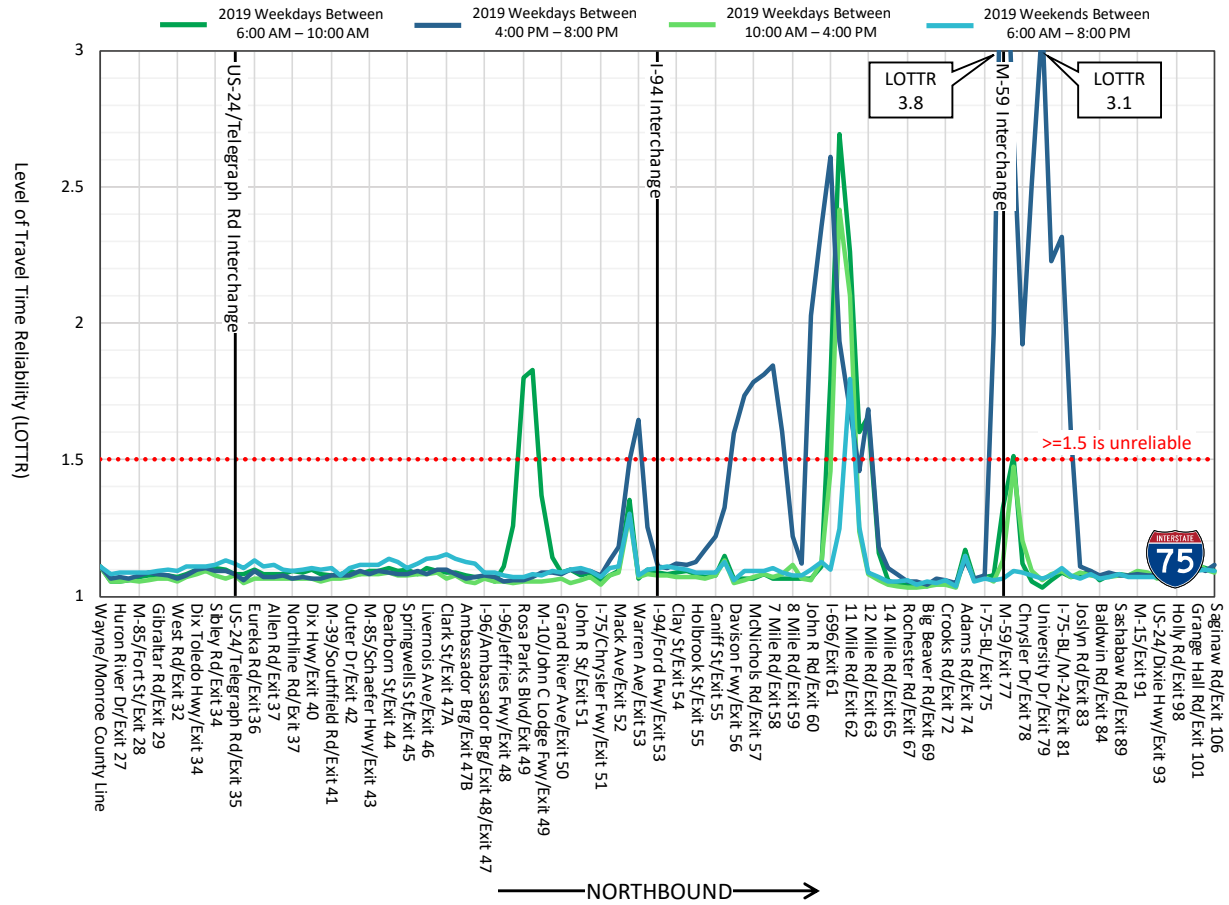


FIGURE 27. Metro Region Northbound I-75 Level of Travel Time Reliability



## I-75: LEVEL OF TRAVEL TIME RELIABILITY

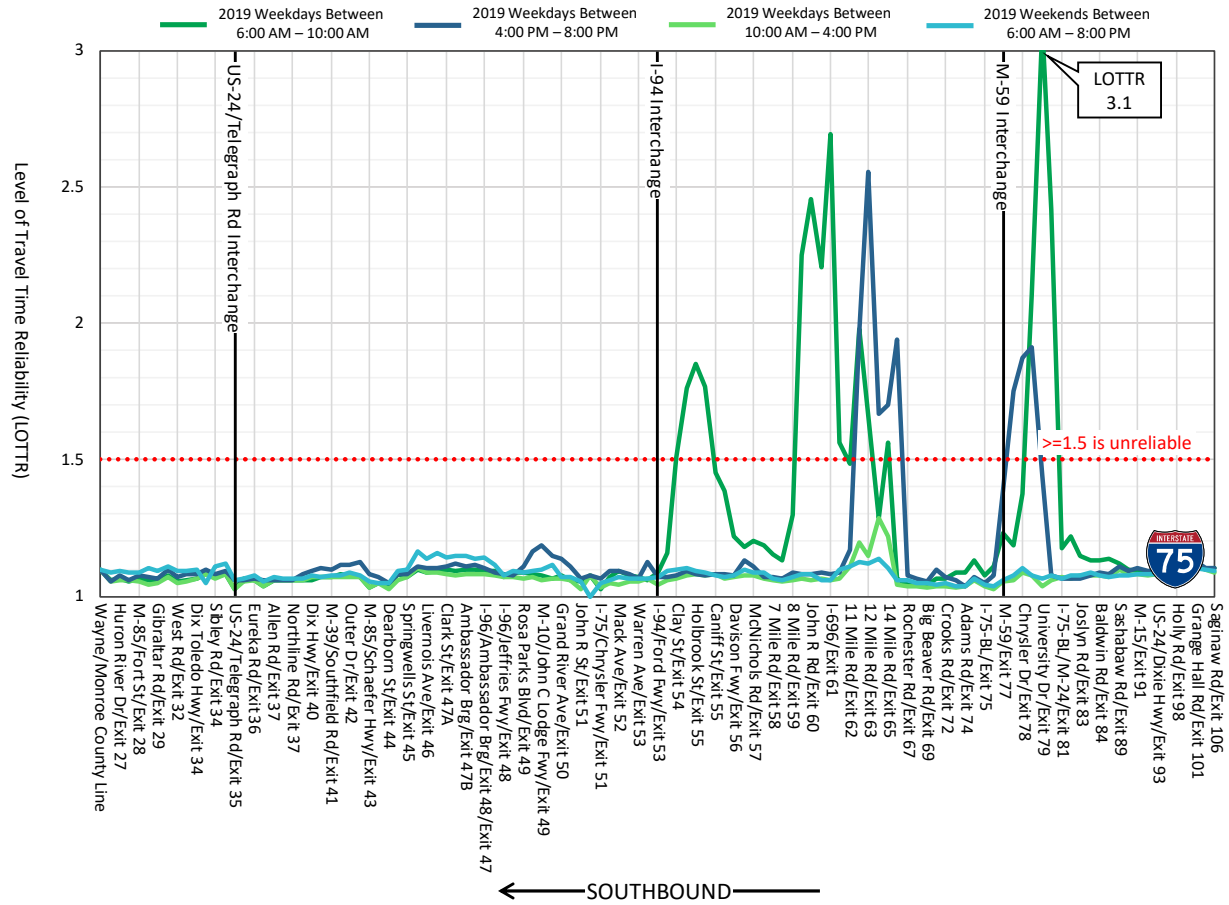
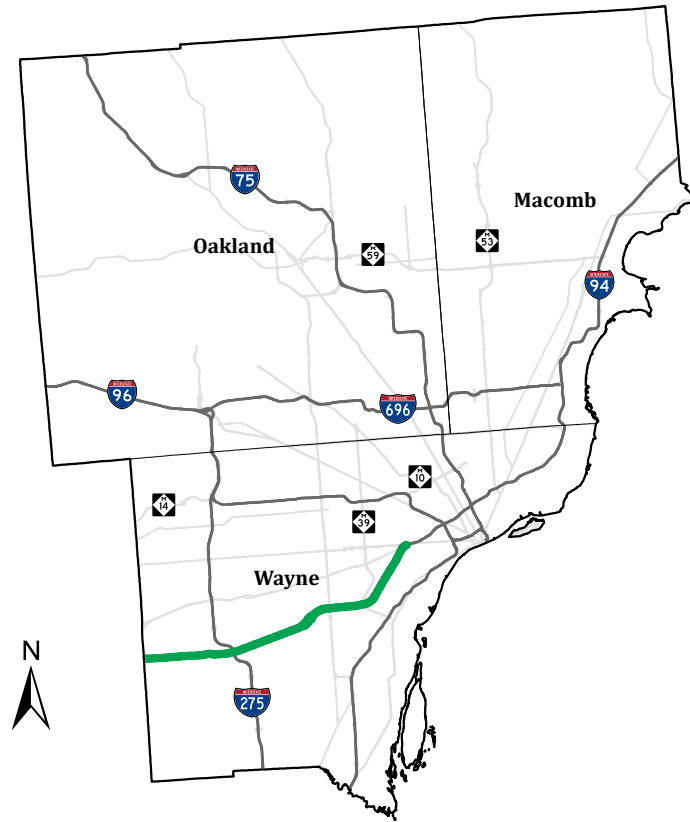


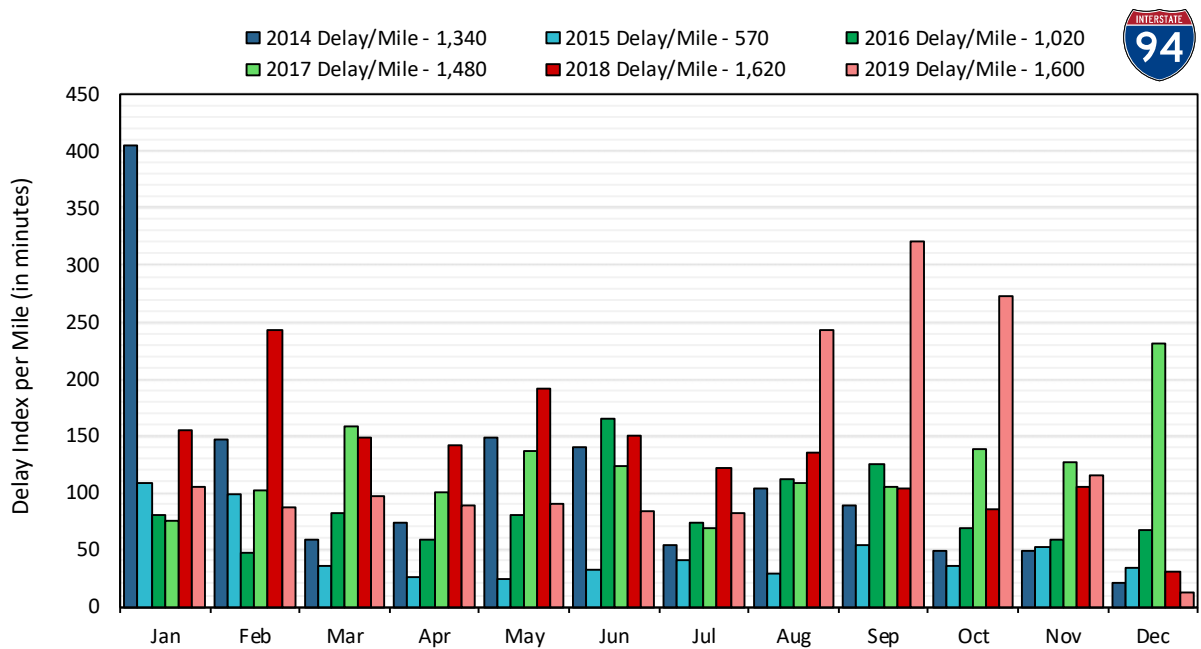
FIGURE 28. Metro Region Southbound I-75 Level of Travel Time Reliability



## I-94: TAYLOR TSC DELAY INDEX



a) Segment Map

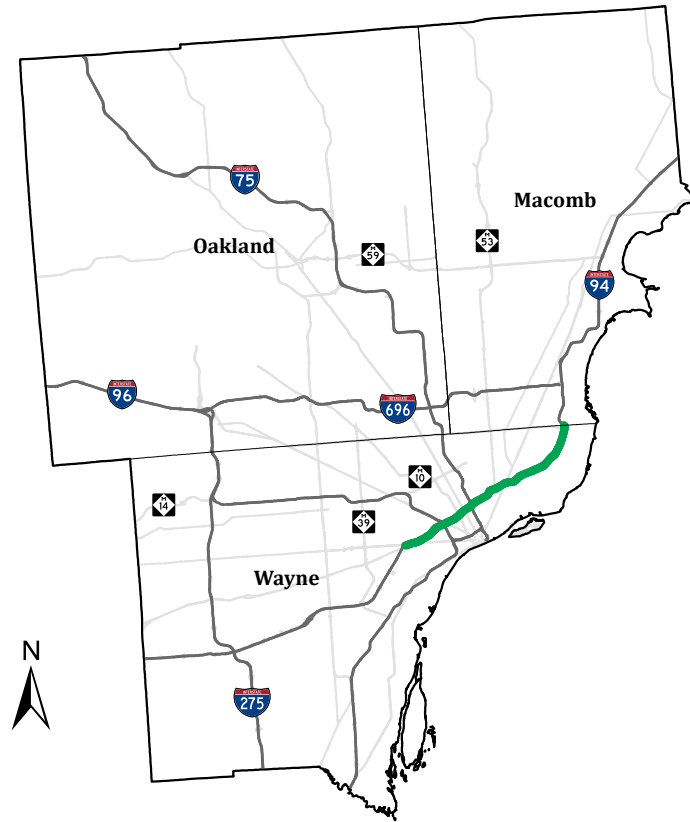


b) Delay Index Graph

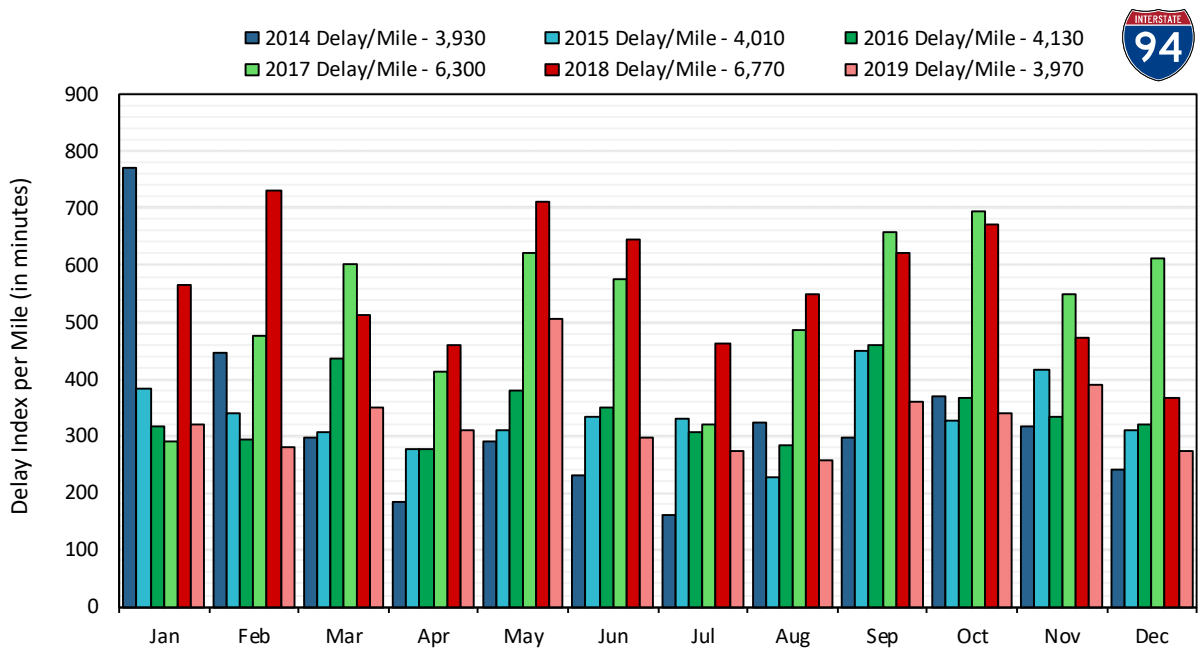
FIGURE 29. Taylor TSC I-94 Corridor Delay Index



## I-94: DETROIT TSC DELAY INDEX (55 MPH)



a) Segment Map



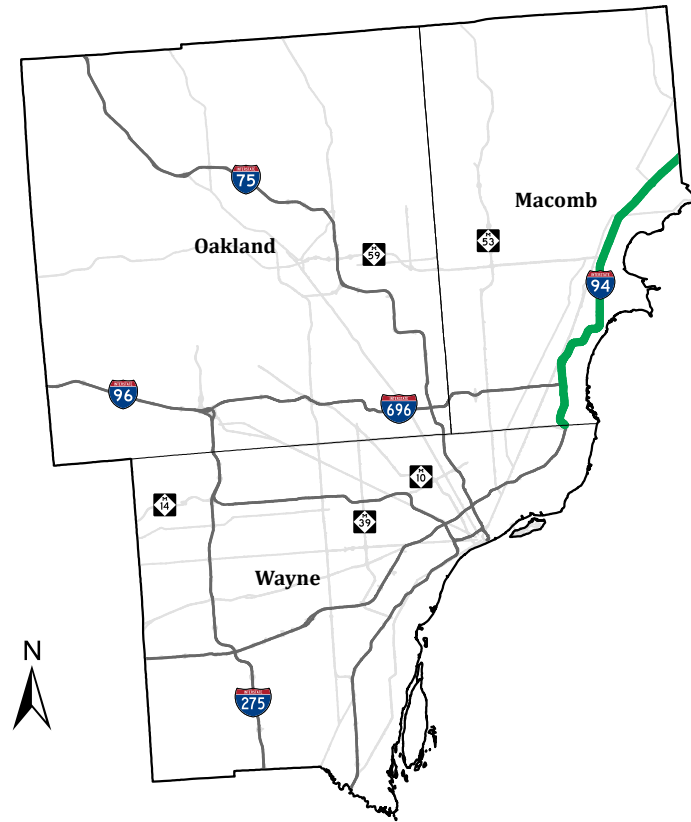
b) Delay Index Graph

FIGURE 30. Detroit TSC (55 MPH) I-94 Corridor Delay Index

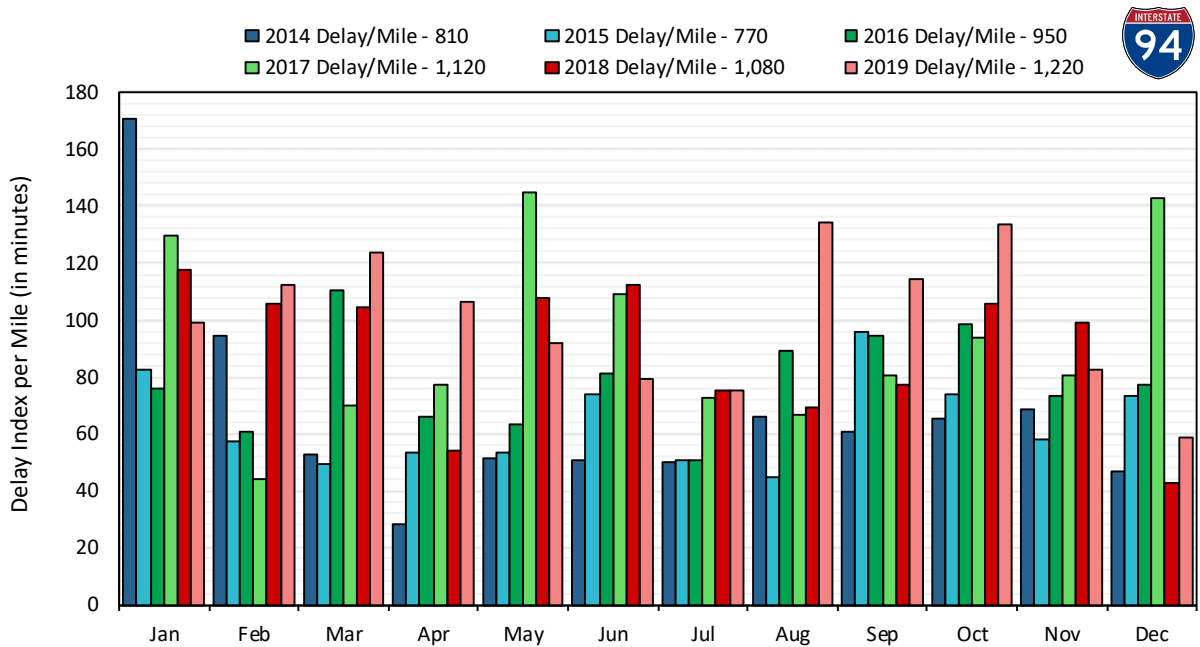




## I-94: MACOMB COUNTY DELAY INDEX



a) Segment Map



b) Delay Index Graph

**FIGURE 31. Macomb County I-94 Corridor Delay Index**



## I-94: AVERAGE SPEED

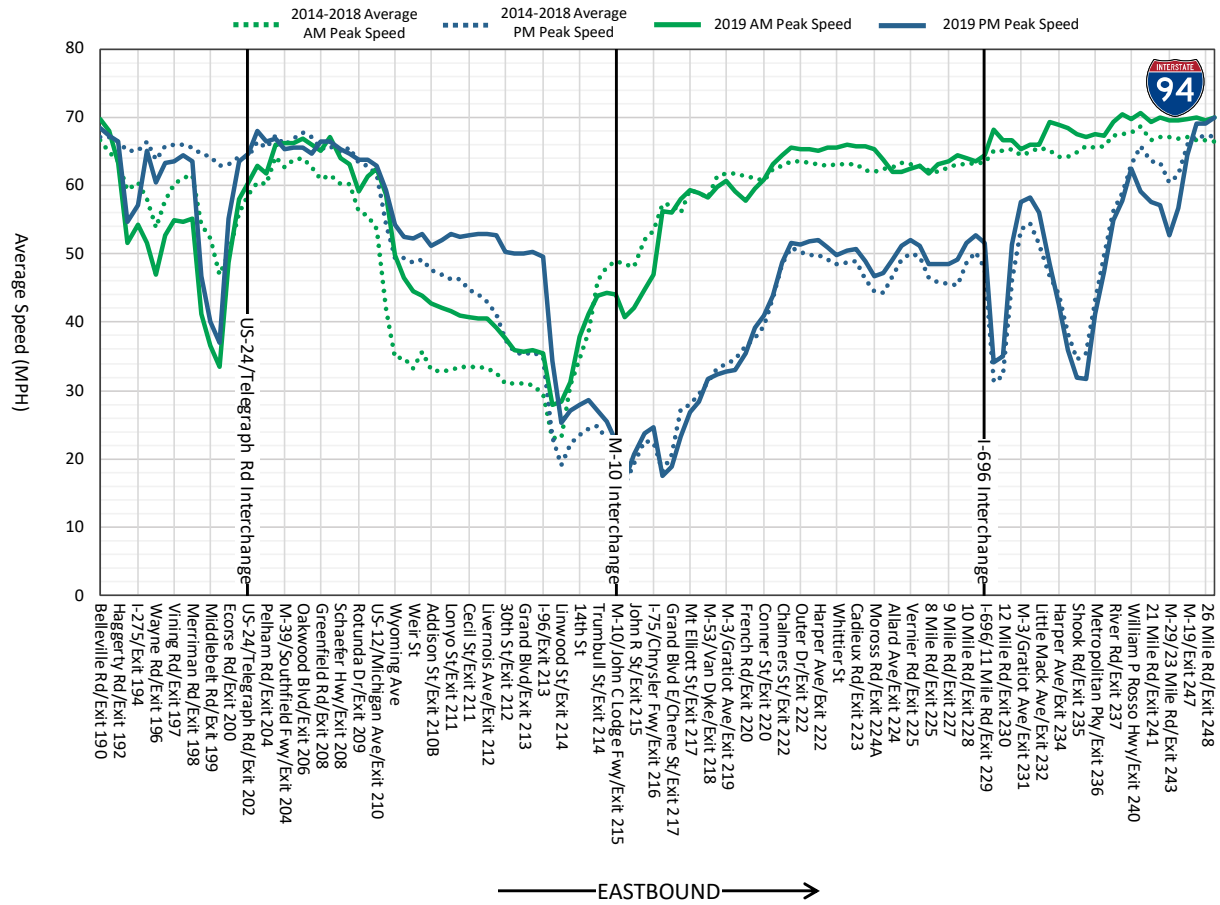
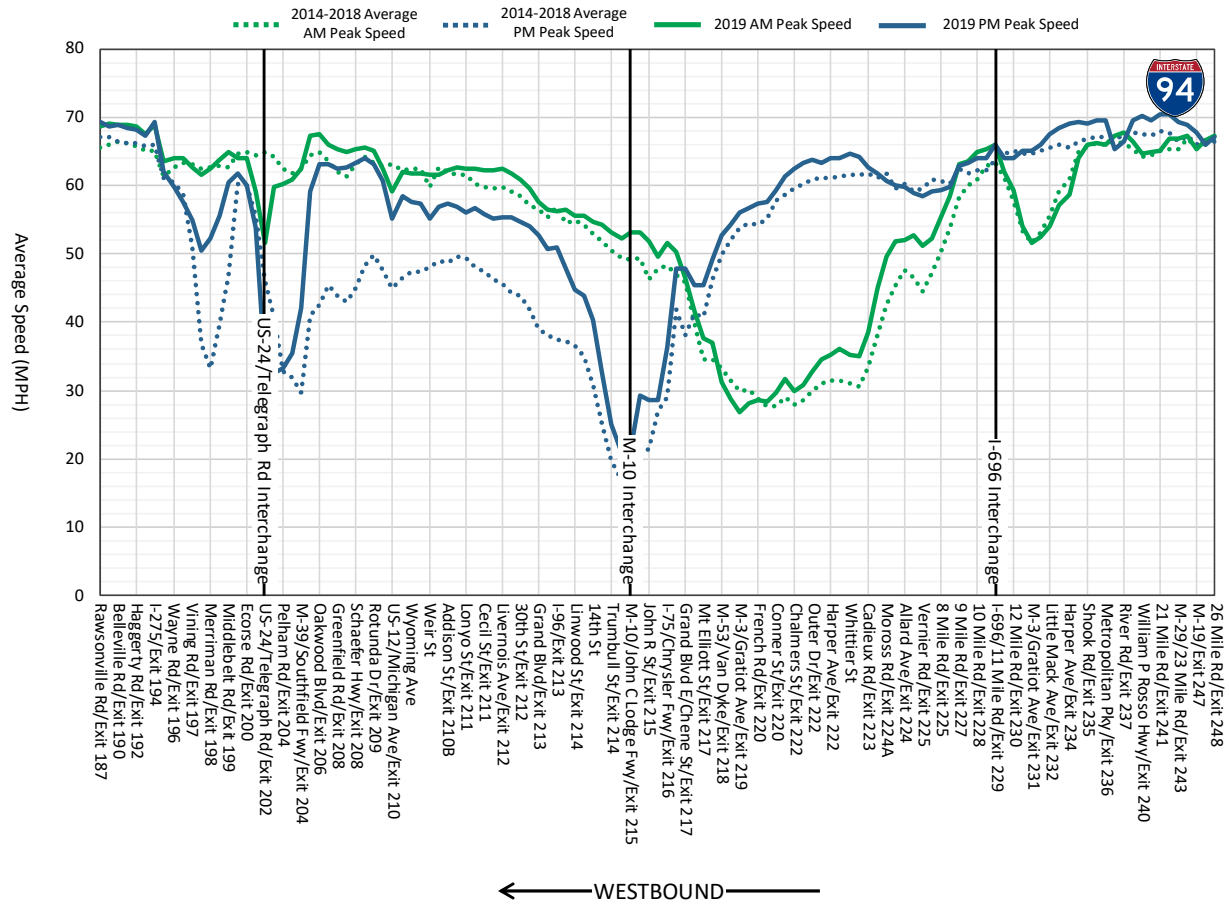


FIGURE 32. Metro Region Eastbound I-94 Average Speed



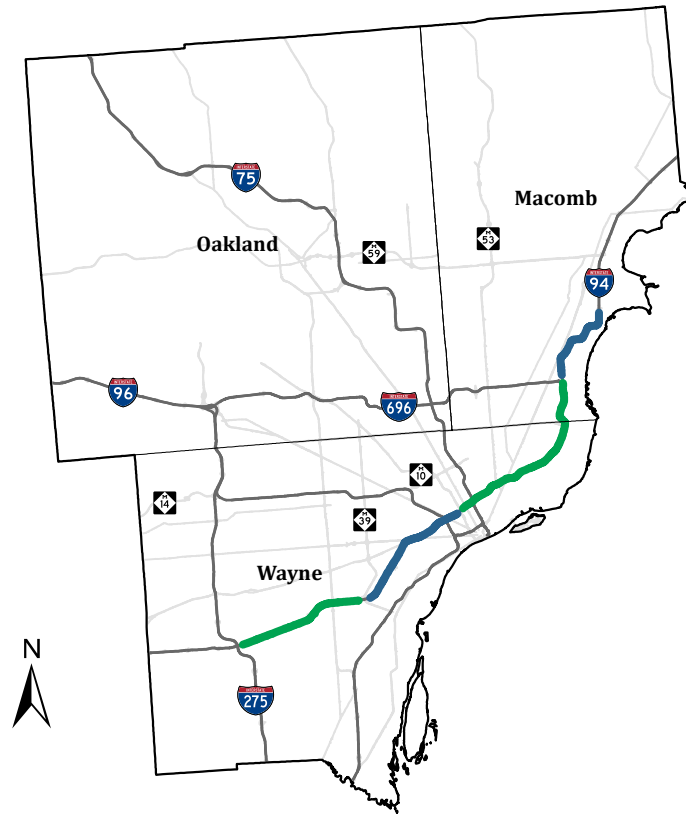
## I-94: AVERAGE SPEED



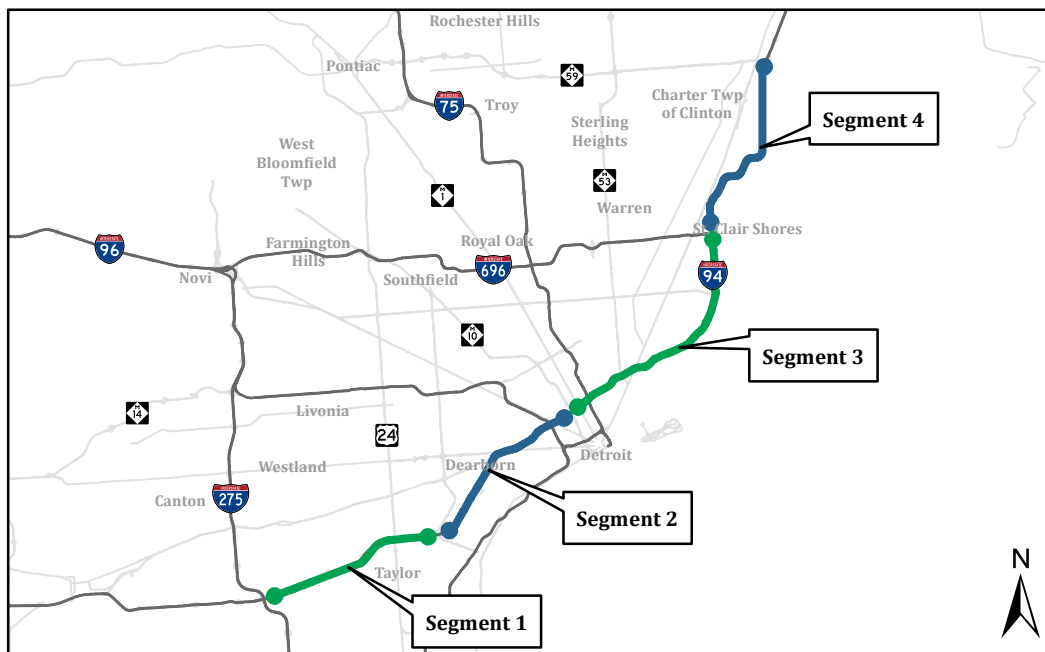
**FIGURE 33. Metro Region Westbound I-94 Average Speed**



## I-94: TRAVEL TIME RELIABILITY



a) Metro Region



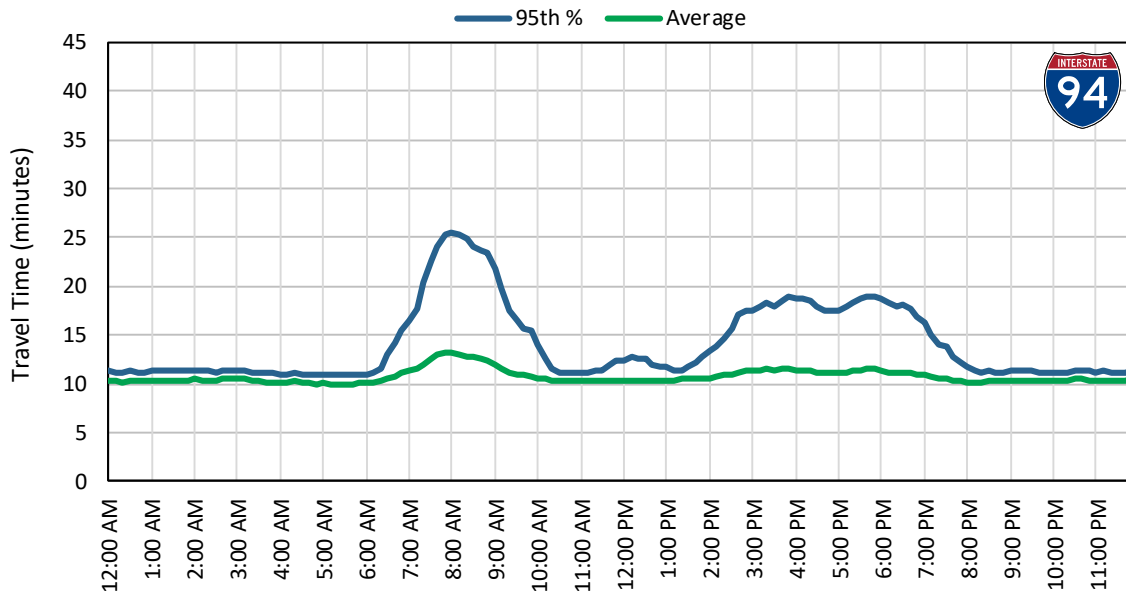
b) Detroit, Michigan

**FIGURE 34. Travel Time Reliability: I-94**

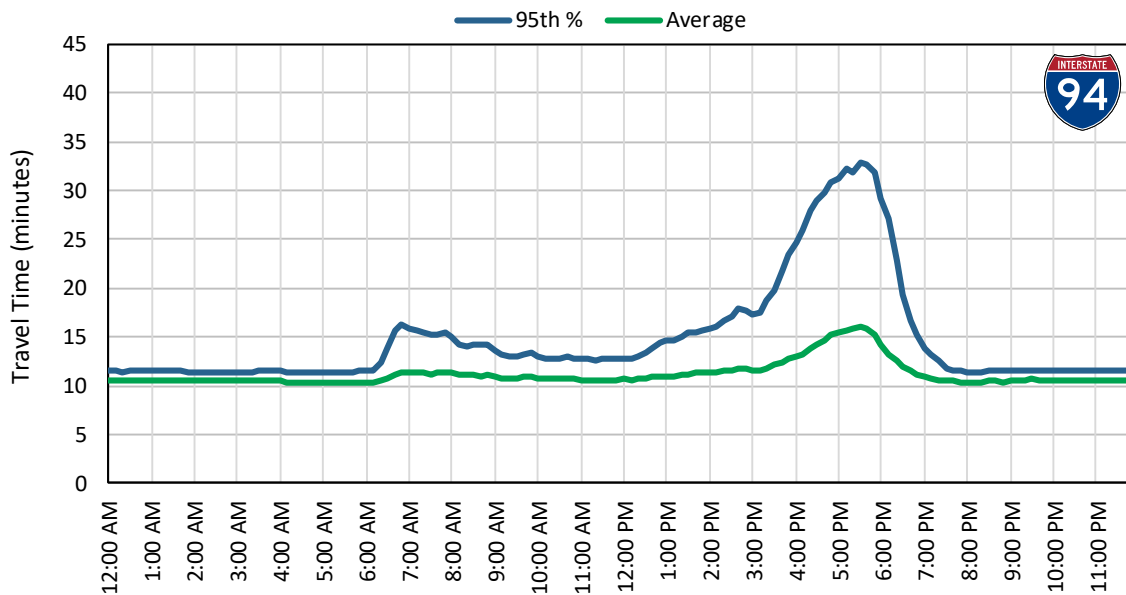




## I-94: TRAVEL TIME RELIABILITY



a) Eastbound

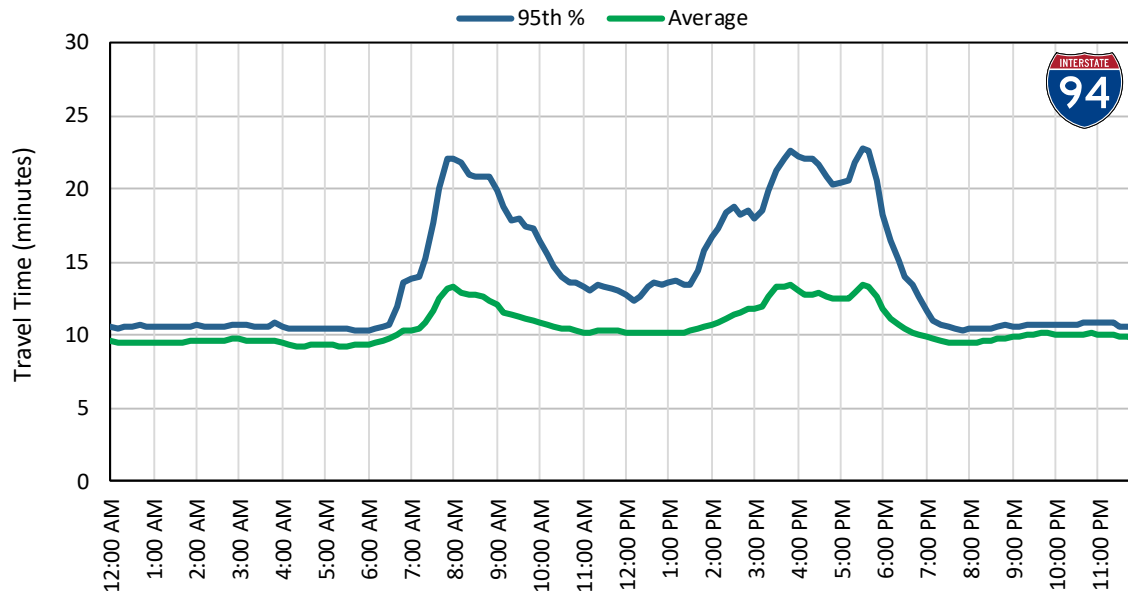


b) Westbound

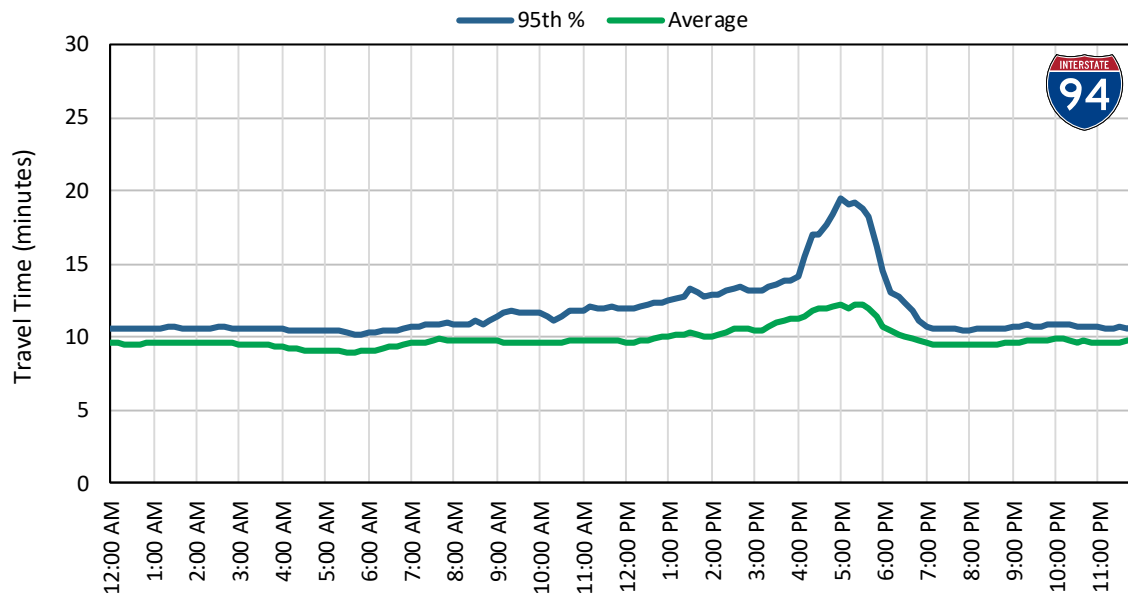
**FIGURE 35. Segment 1 - I-94 between I-275/Exit 194 and M-39/Southfield Fwy/Exit 204**



## I-94: TRAVEL TIME RELIABILITY



a) Eastbound

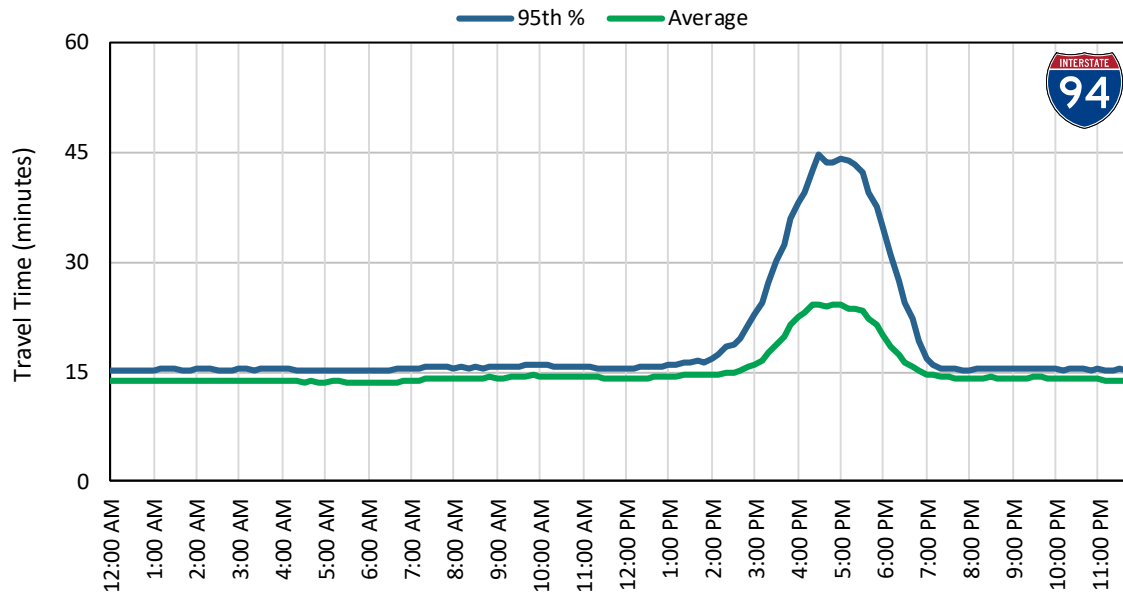


b) Westbound

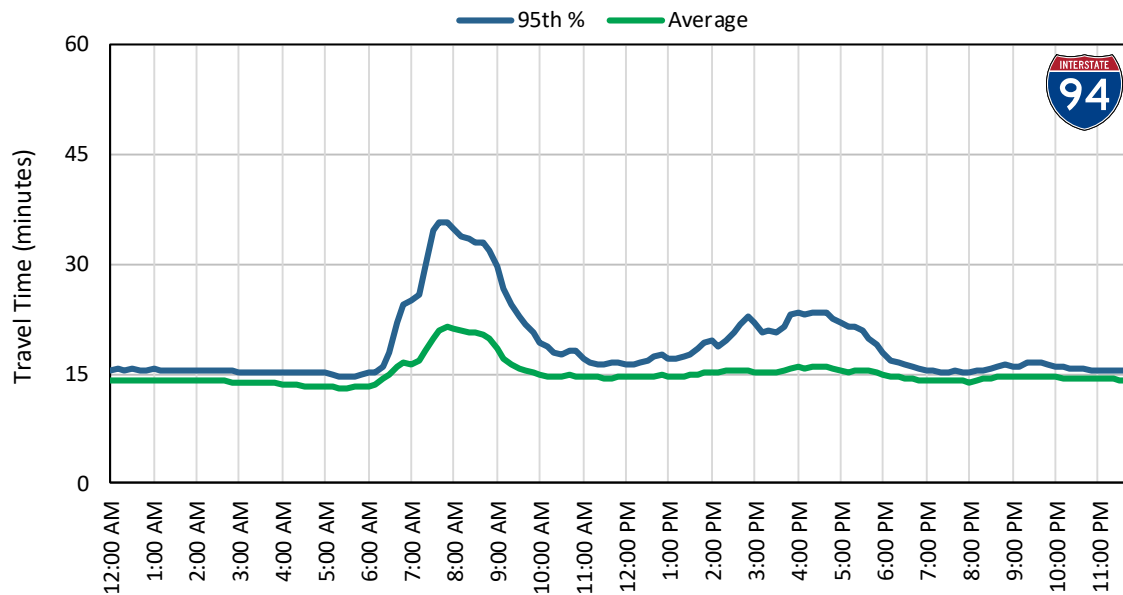
**FIGURE 36. Segment 2 - I-94 between M-39/Southfield Fwy/Exit 204 and M-10/John C Lodge Fwy/Exit 215**



## I-94: TRAVEL TIME RELIABILITY



a) Eastbound

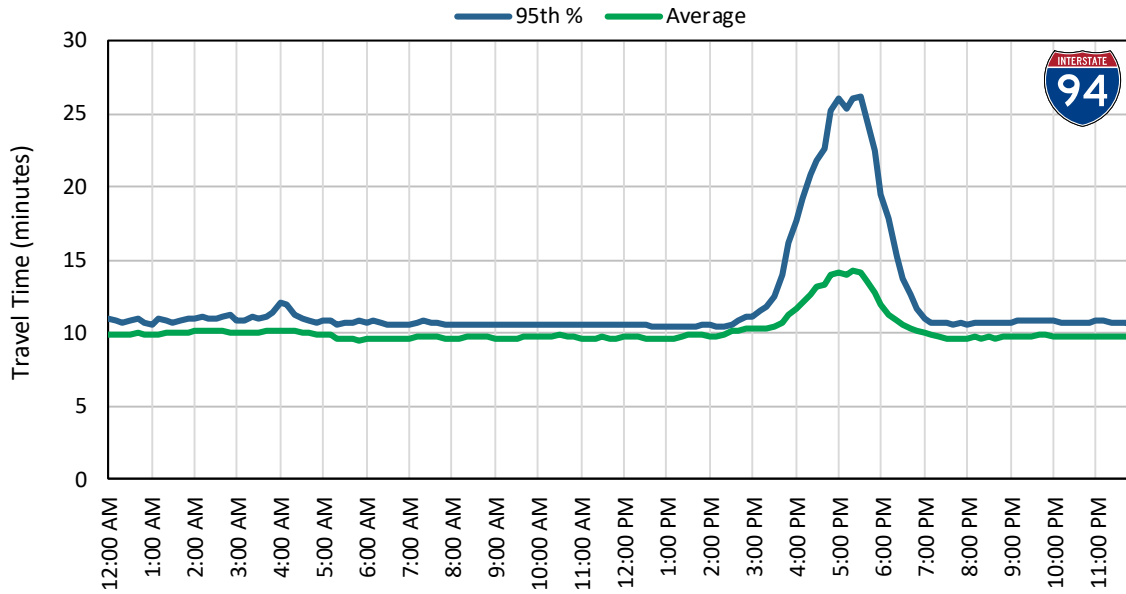


b) Westbound

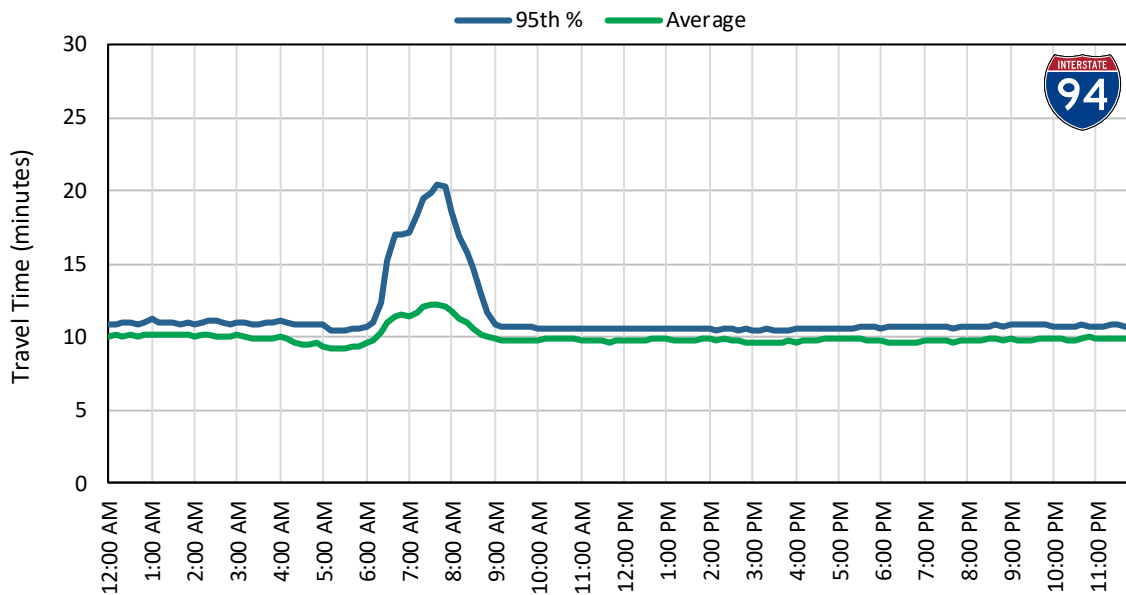
**FIGURE 37. Segment 3 - I-94 between M-10/John C Lodge Fwy/Exit 215 and I-696/11 Mile Rd/Exit 229**



## I-94: TRAVEL TIME RELIABILITY



a) Eastbound



b) Westbound

**FIGURE 38.** Segment 4 - I-94 between I-696/11 Mile Rd/Exit 229 and William P Rosso Hwy/Exit 240



## I-94: LEVEL OF TRAVEL TIME RELIABILITY

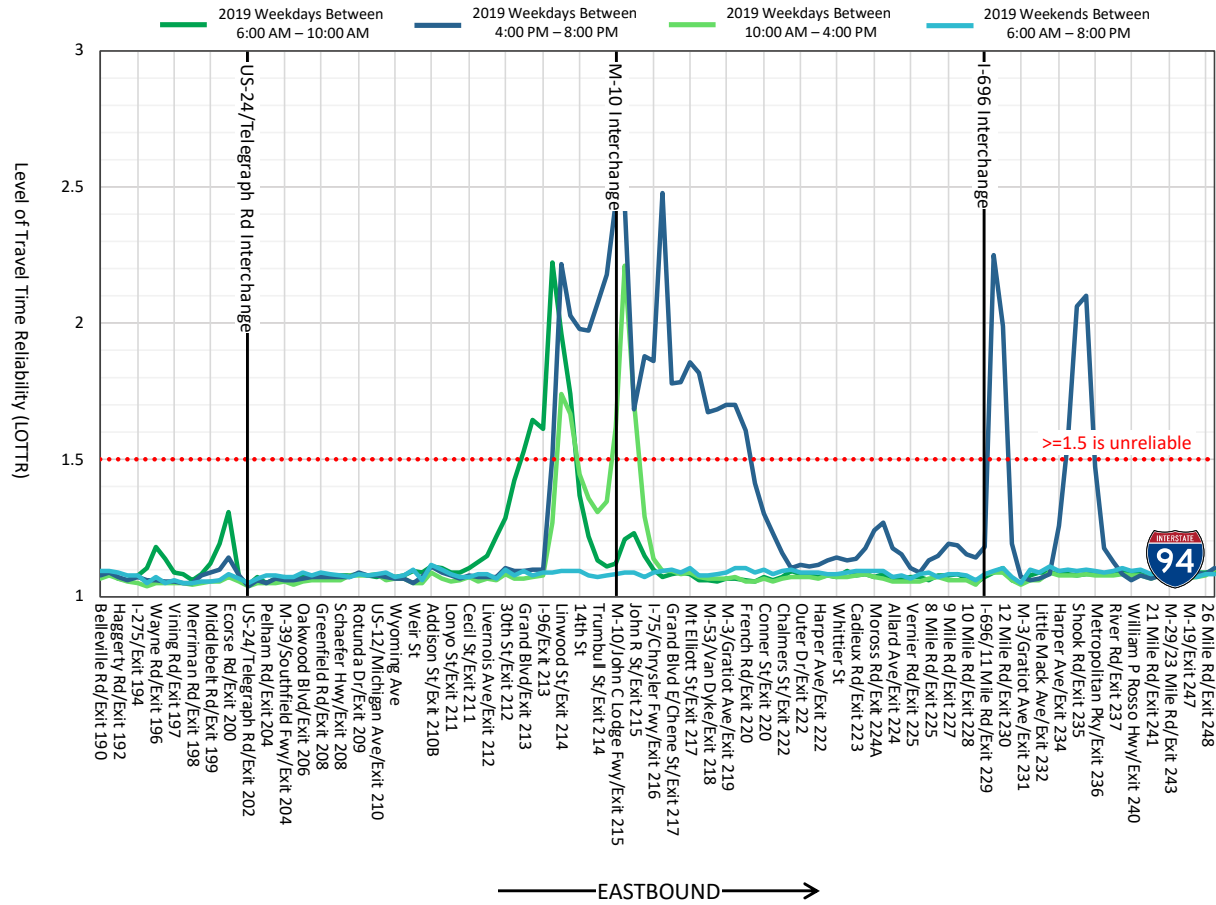
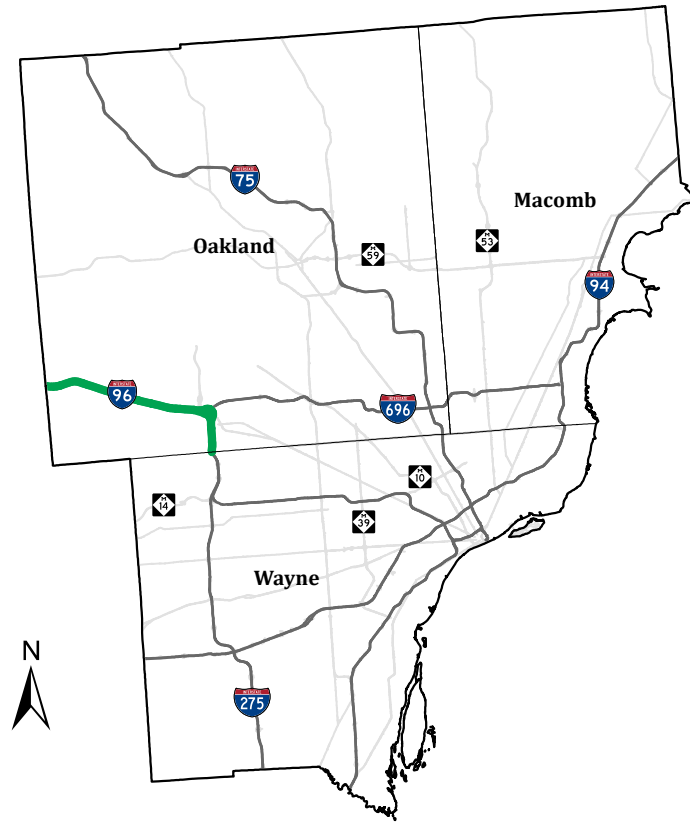


FIGURE 39. Metro Region Eastbound I-94 Level of Travel Time Reliability

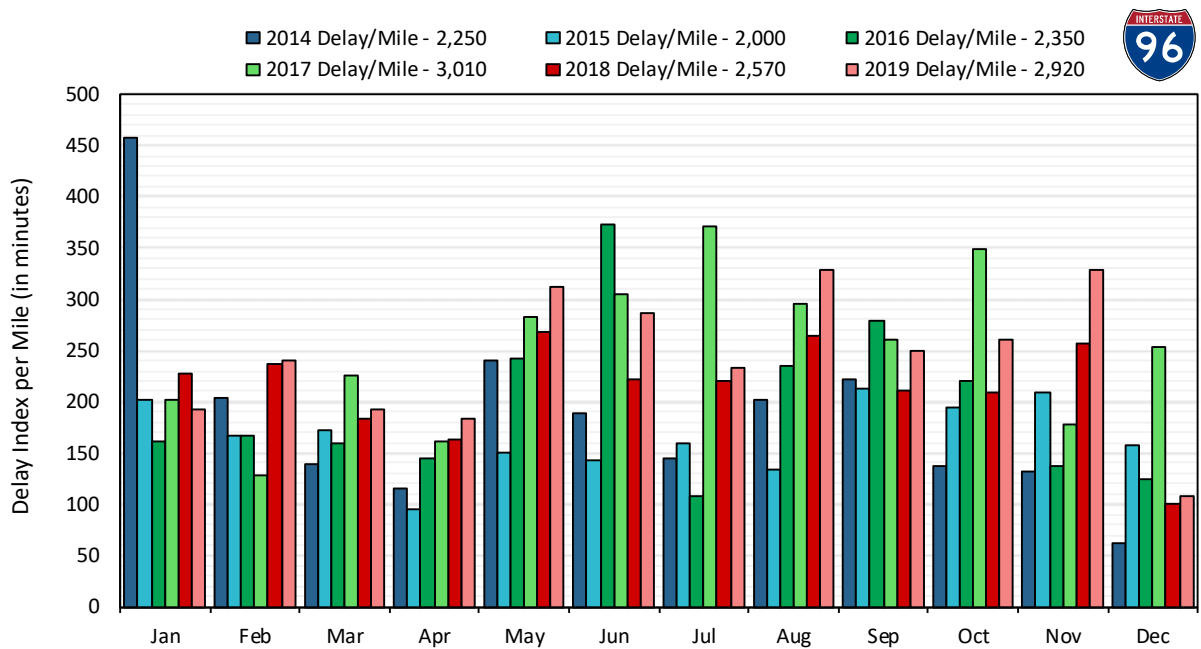
**FIGURE 40. Metro Region Westbound I-94 Level of Travel Time Reliability**



## I-96: OAKLAND COUNTY DELAY INDEX



a) Segment Map



b) Delay Index Graph

**FIGURE 41. Oakland County I-96 Corridor Delay Index**



## I-96: TAYLOR TSC DELAY INDEX

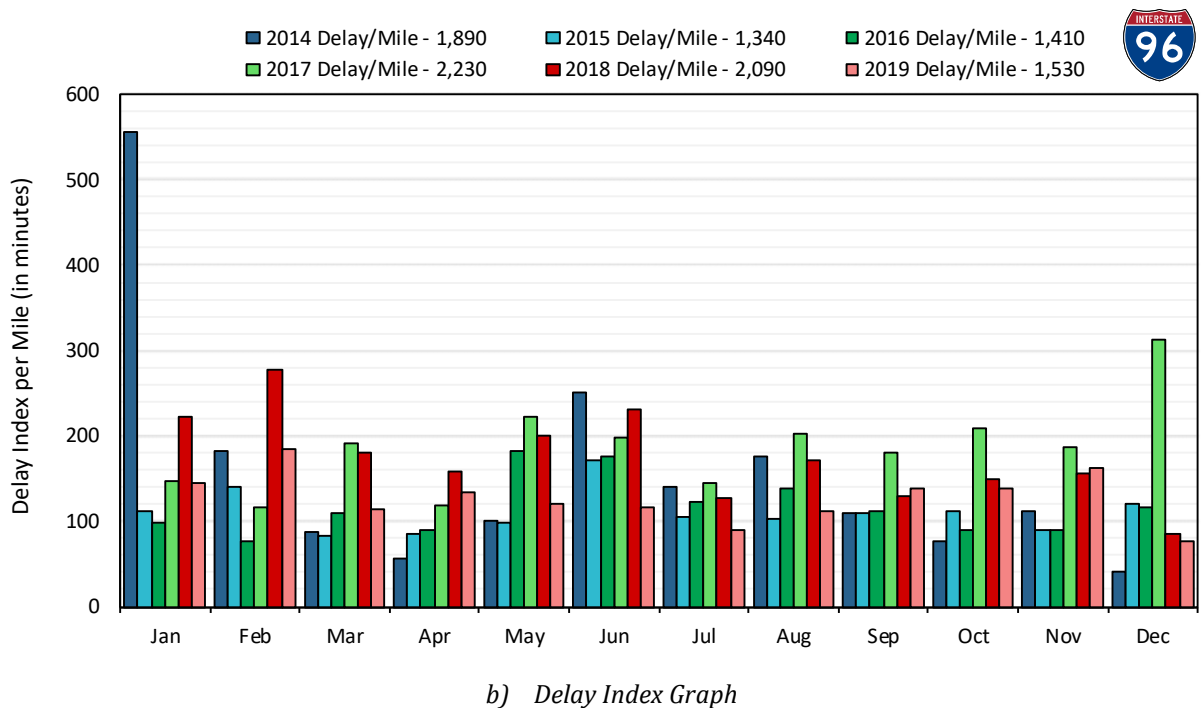
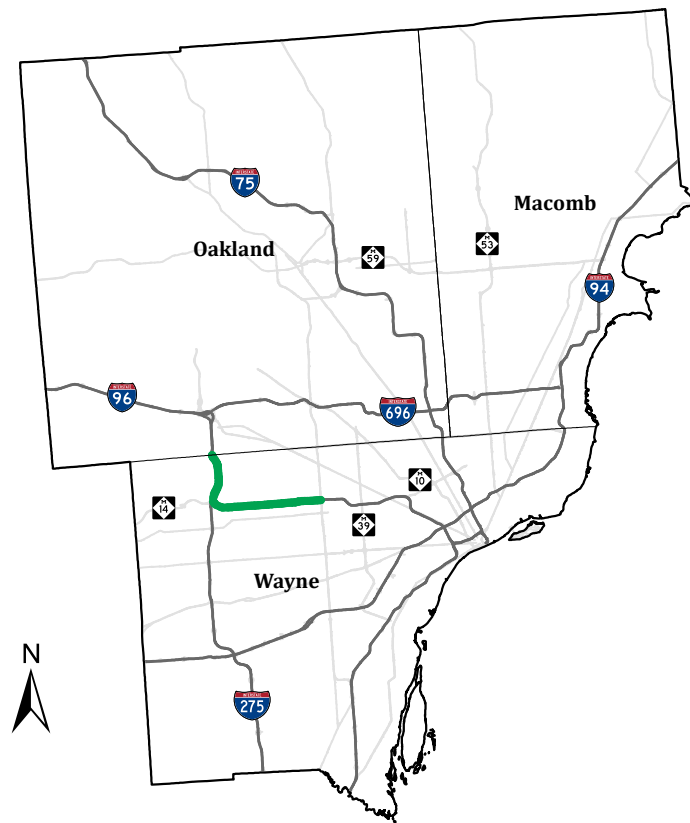
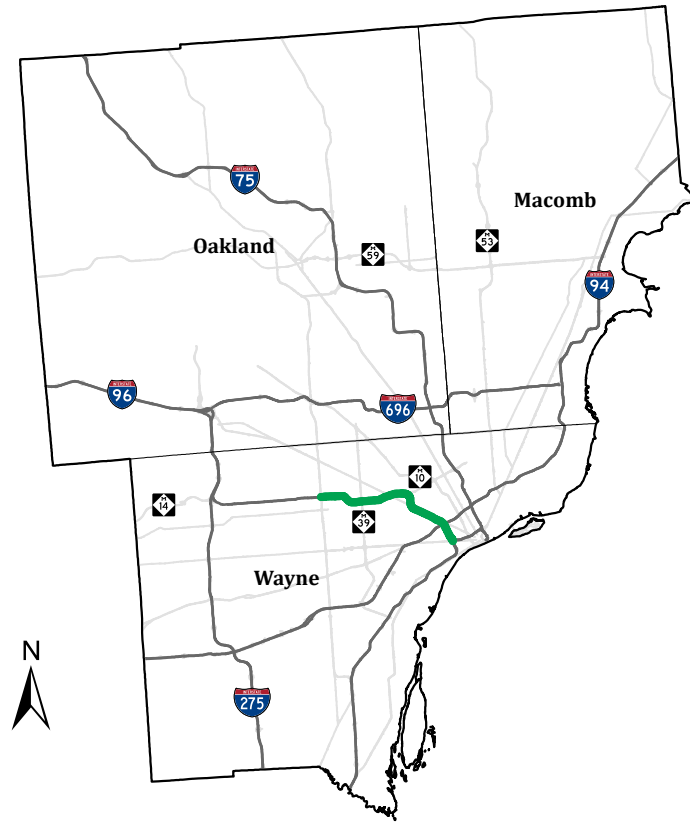


FIGURE 42. Taylor TSC I-96 Corridor Delay Index

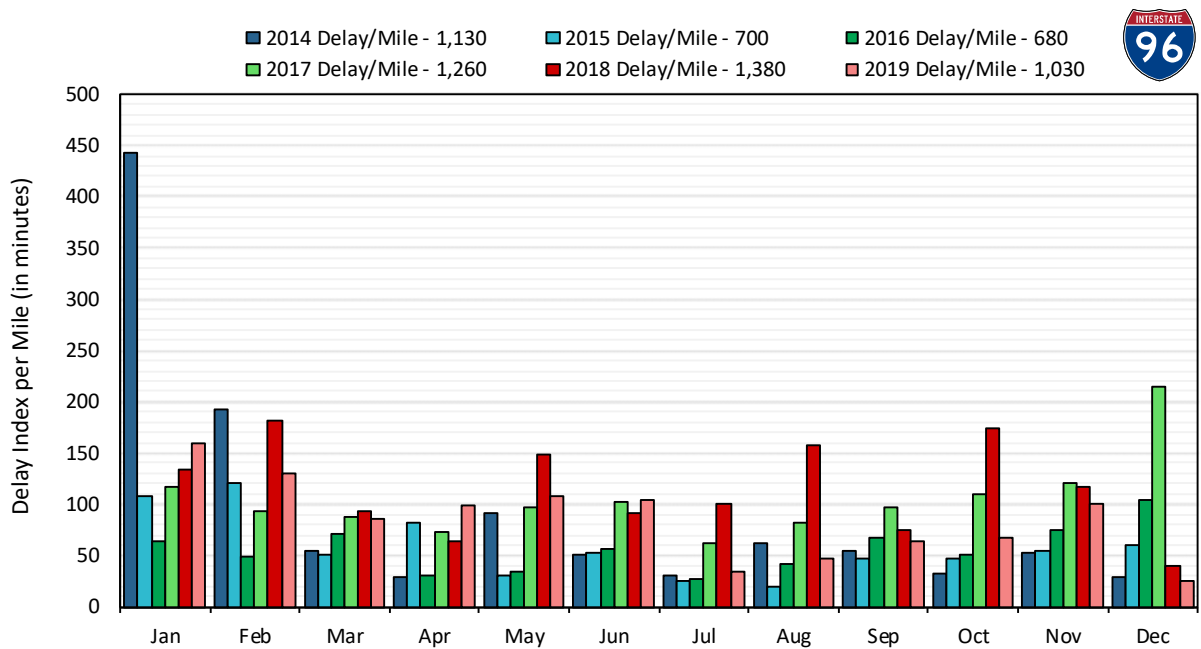




## I-96: DETROIT TSC DELAY INDEX



a) Segment Map

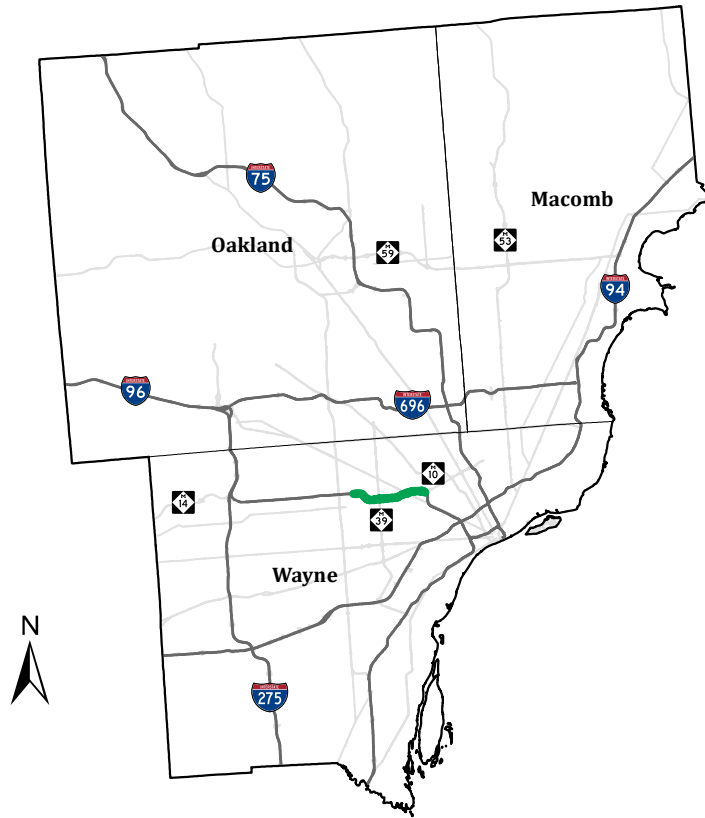


b) Delay Index Graph

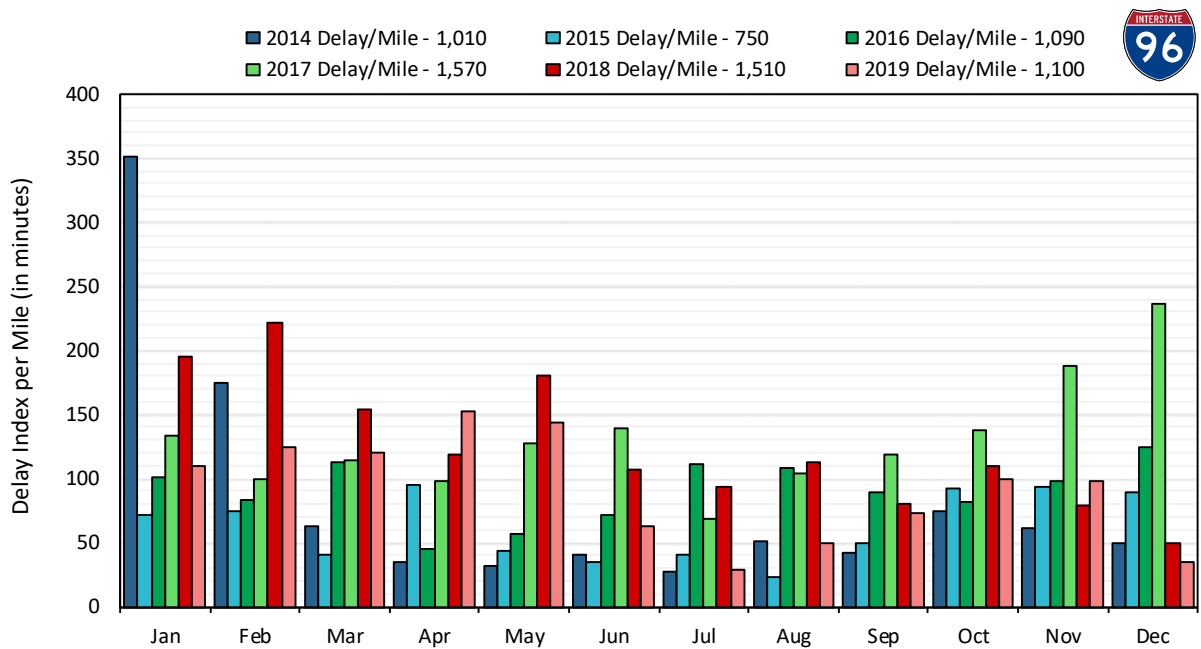
**FIGURE 43. Detroit TSC I-96 Corridor Delay Index**



## I-96 LOCAL: DETROIT TSC DELAY INDEX (55 MPH)



a) Segment Map



b) Delay Index Graph

FIGURE 44. Detroit TSC I-96 LOCAL (55 MPH) Corridor Delay Index





## I-96: AVERAGE SPEED

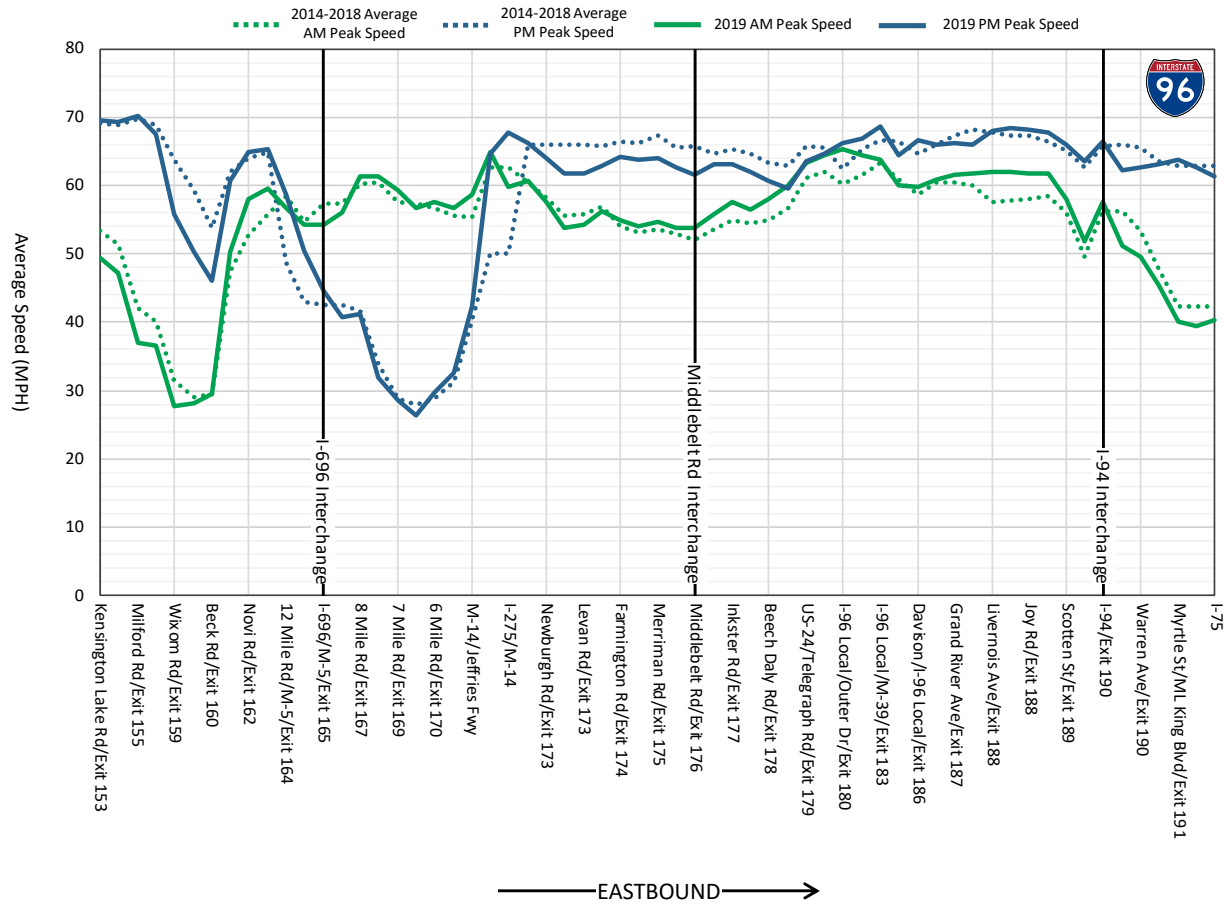


FIGURE 45. Metro Region Eastbound I-96 Average Speed



## I-96: AVERAGE SPEED

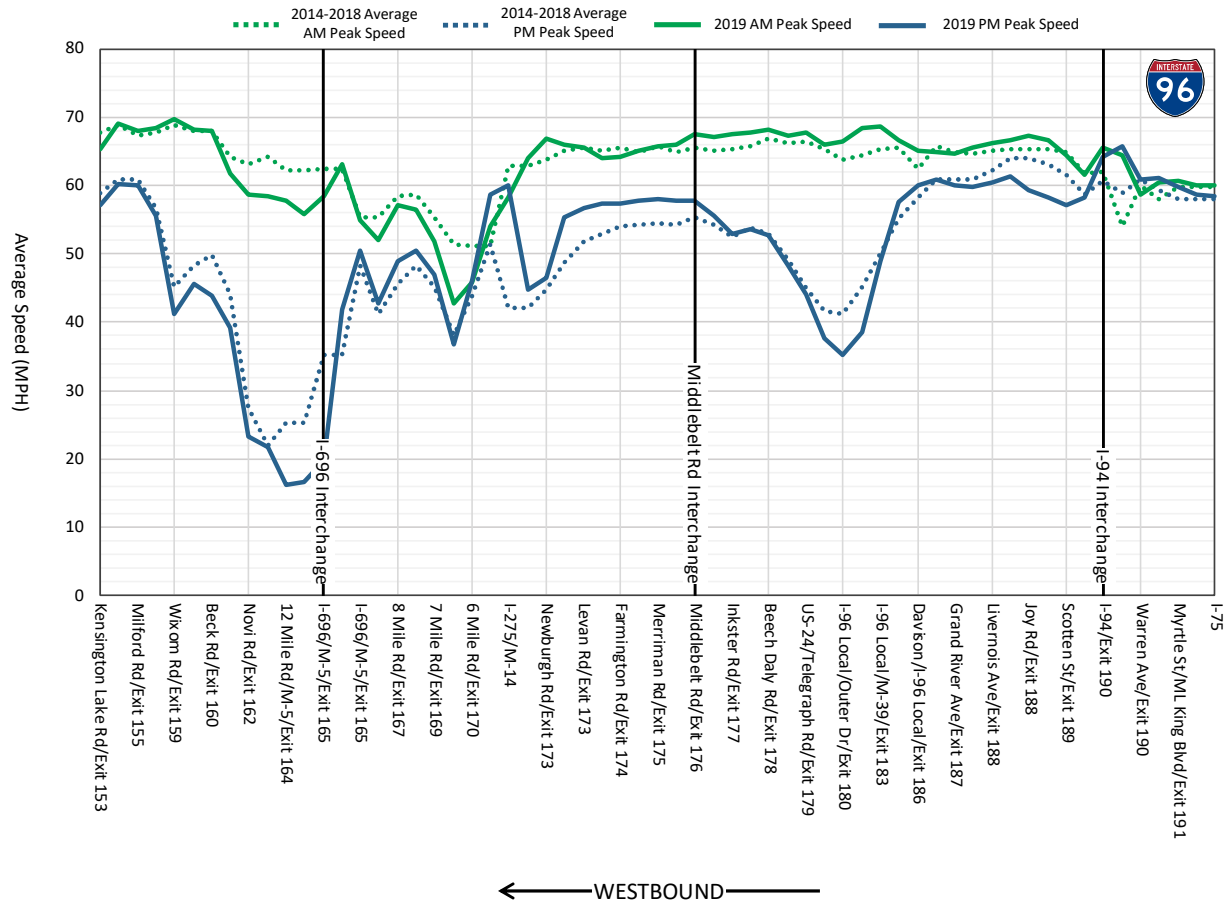


FIGURE 46. Metro Region Westbound I-96 Average Speed



## I-96 LOCAL: AVERAGE SPEED

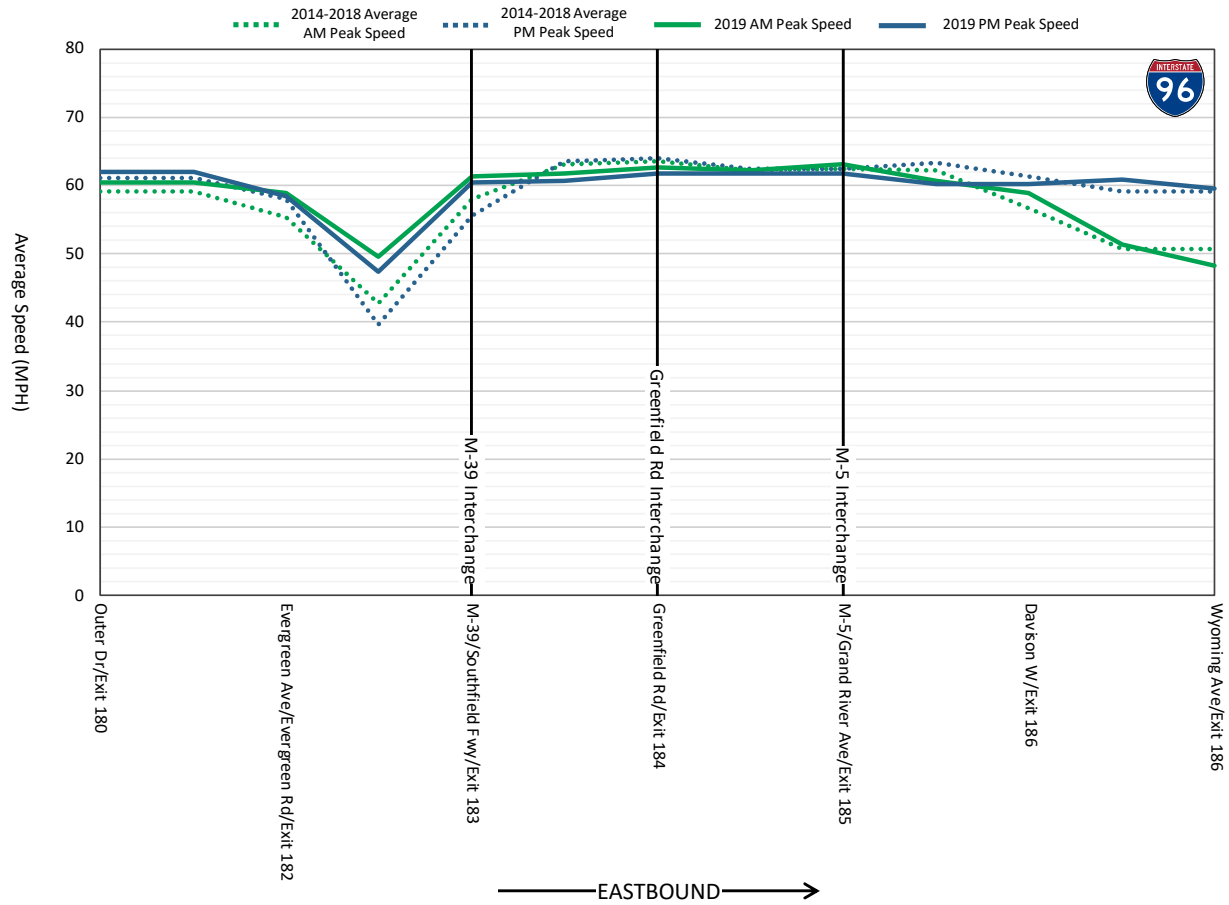


FIGURE 47. Metro Region Eastbound I-96 LOCAL Average Speed



## I-96 LOCAL: AVERAGE SPEED

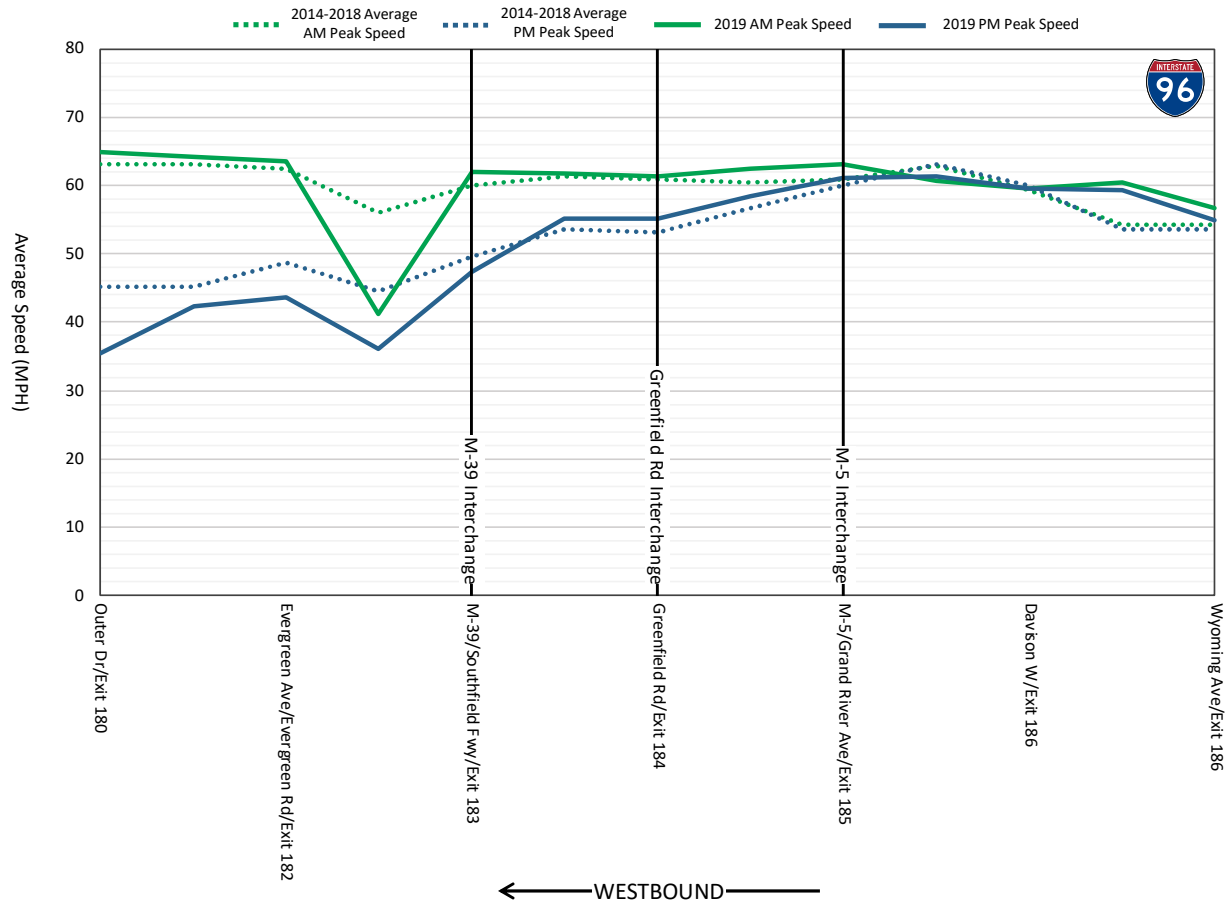
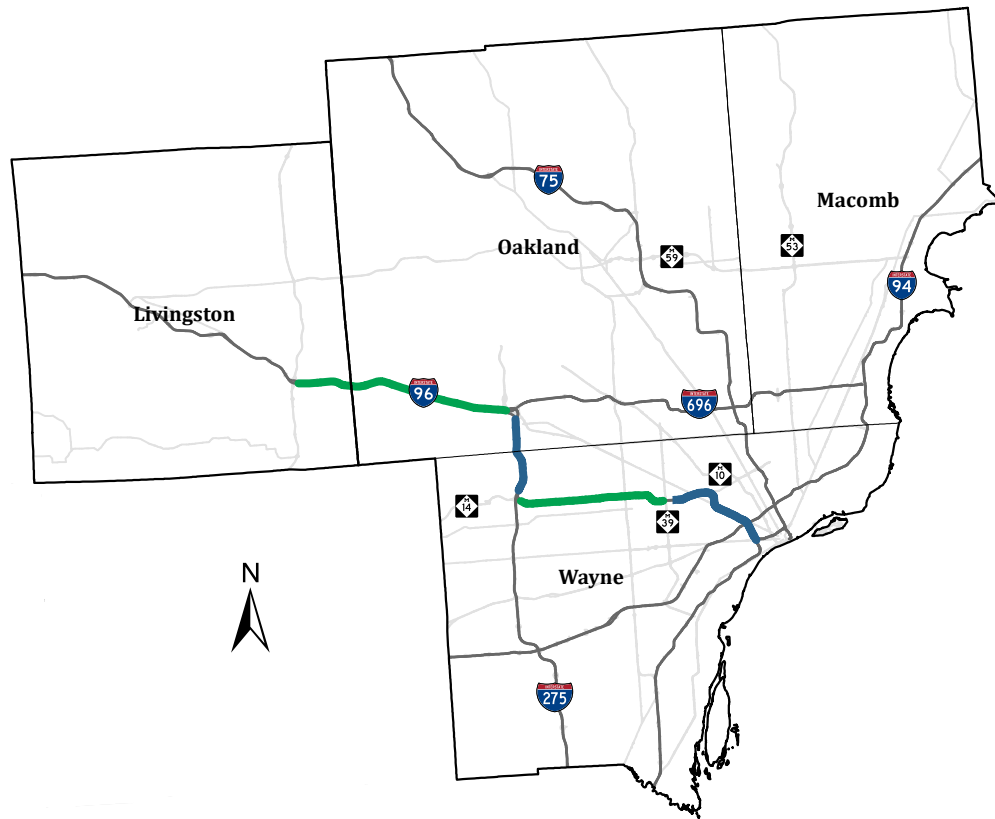


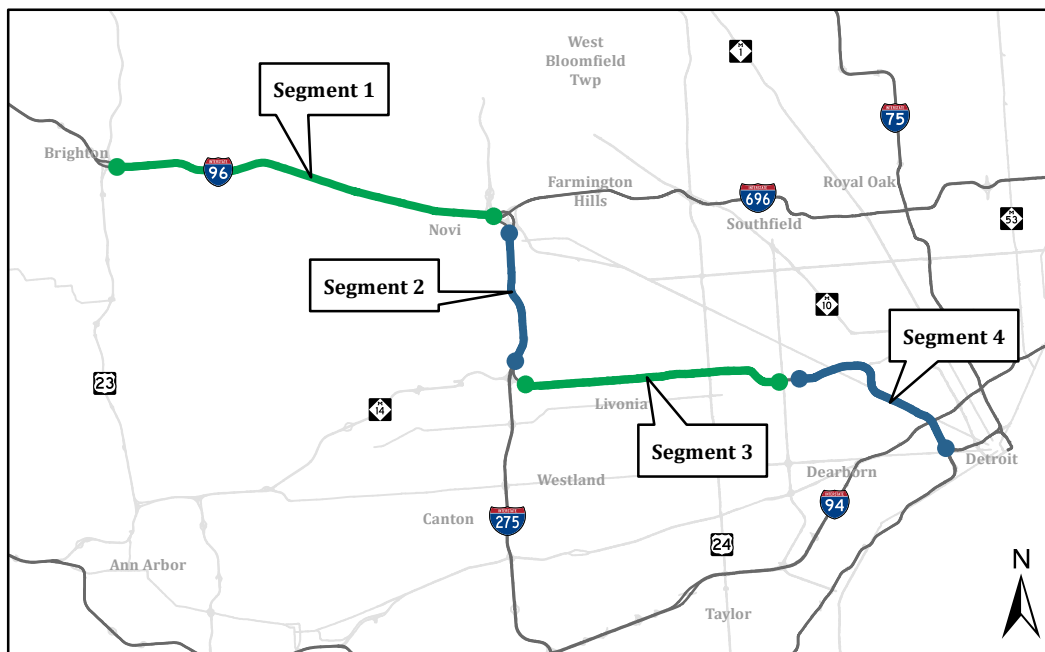
FIGURE 48. Metro Region Westbound I-96 LOCAL Average Speed



## I-96: TRAVEL TIME RELIABILITY



*a) Metro Region and Livingston County*

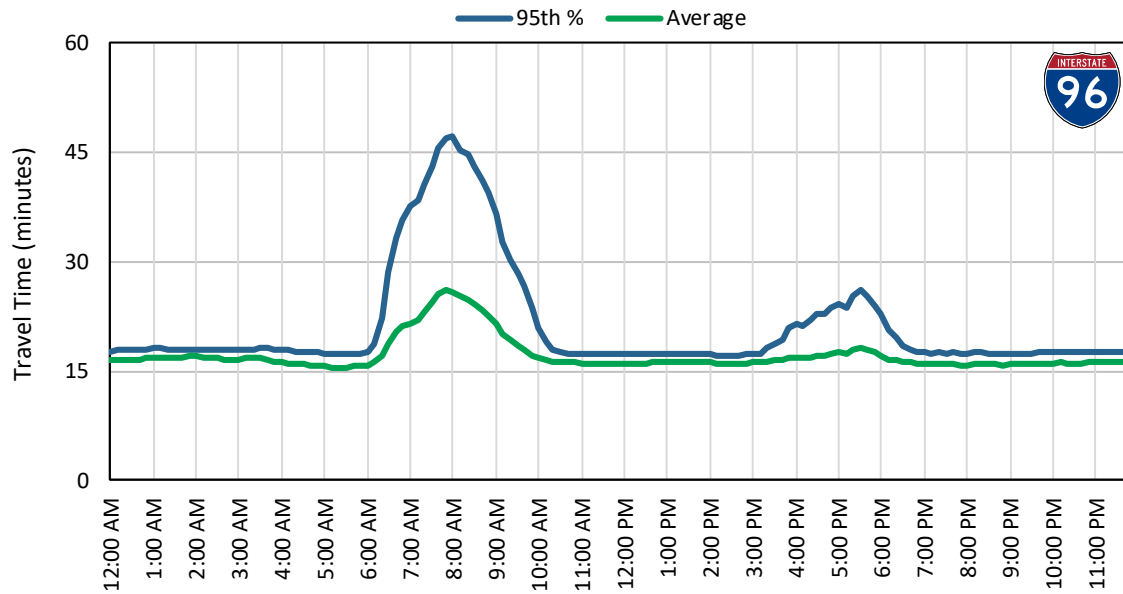


*b) Detroit, Michigan*

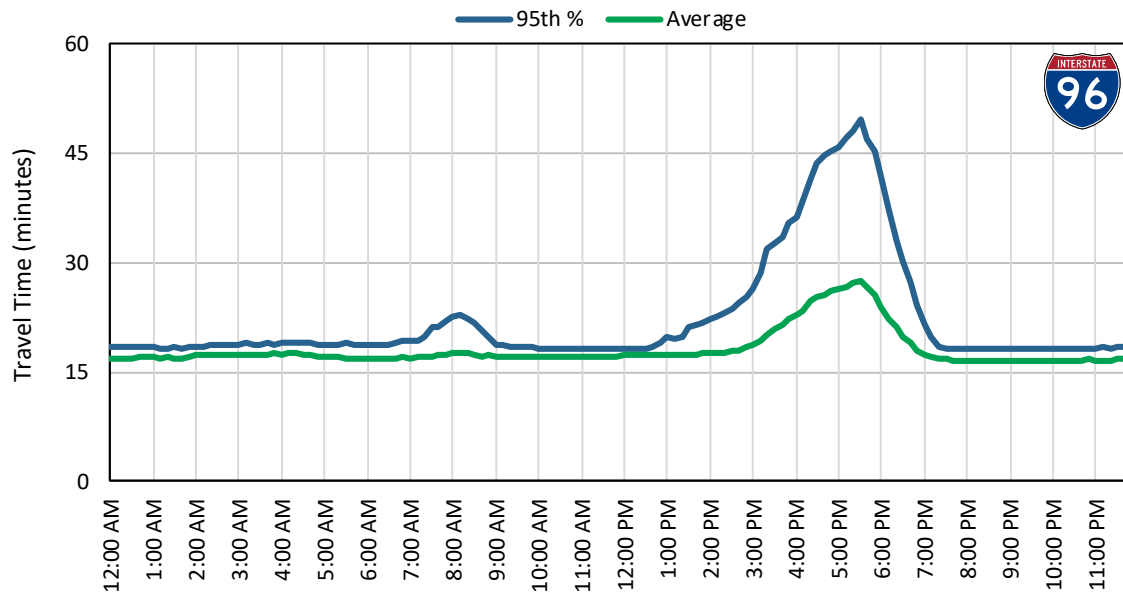
**FIGURE 49. Travel Time Reliability: I-96**



## I-96: TRAVEL TIME RELIABILITY



a) Eastbound



b) Westbound

**FIGURE 50. Segment 1 - I-96 between US-23/Exit 148 and I-696/M-5/Exit 165**